ZOOLOGICA

SCIENTIFIC CONTRIBUTIONS OF THE NEW YORK ZOOLOGICAL SOCIETY

VOLUME II, NUMBERS 3 & 4

No. 3. NOTES ON THE BIRDS OF PARÁ, BRAZIL

No. 4. FAUNA OF FOUR SQUARE FEET OF JUNGLE DEBRIS

By

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curator of birds

PUBLISHED BY THE SOCIETY
THE ZOOLOGICAL PARK, NEW YORK

February, 1916

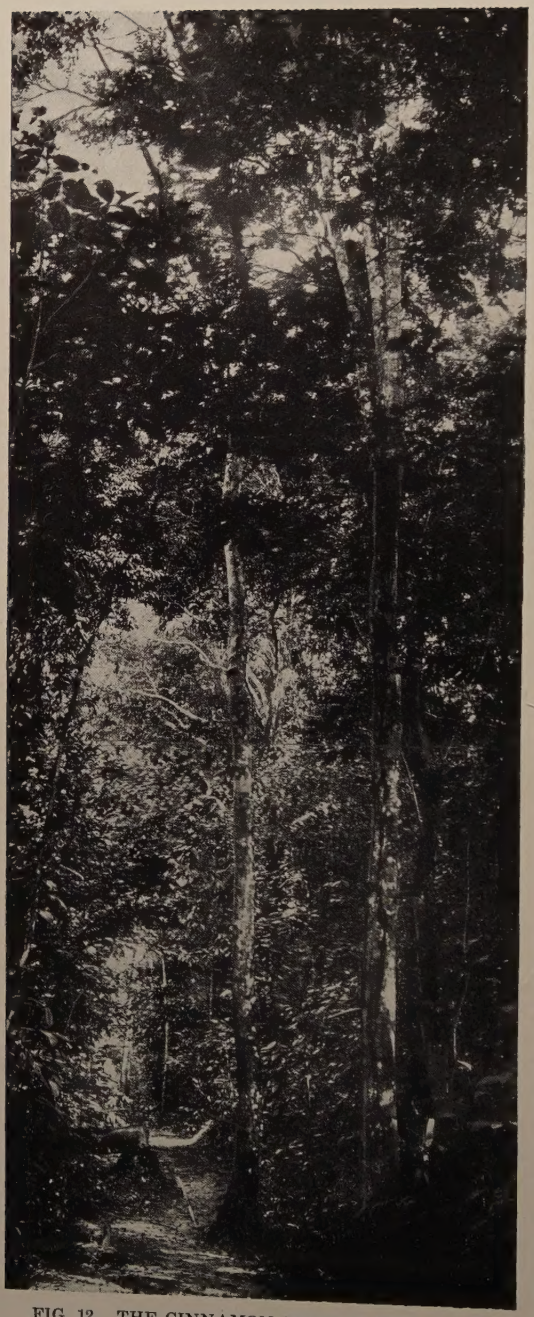

FIG. 12. THE CINNAMON TREE OF THE BIRDS
The Utinga Jungle

NOTES ON THE BIRDS OF PARÁ, BRAZIL

By C. William Beebe,
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Part I.—Introduction.

Belem or Pará is a city of about two hundred thousand inhabitants. It is a hundred miles from the sea, on the south bank of the Amazon delta, and only one hundred and sixty kilometres south of the equator, built on low swampy land. The birds in the vicinity have been collected assiduously and offer little chance of novelty to the transient ornithologist.

During the first part of May of the present year I had the opportunity of spending a little time in the jungle in the immediate suburbs of Pará. Through the courtesy of the Governor and of Dr. Snethlage I was given the use of a house at the water-works, in a large restricted area of jungle known as Utinga, and here every facility was afforded for collecting and study. Unexpectedly meeting Mr. George K. Cherrie, who had just come down the Amazon, I prevailed upon him to share our opportunities and with my companion Mr. G. Inness Hartley, spent a few days together. I found the region to be of much greater interest than I had expected and by resorting to a rather novel method of observation I obtained a new angle upon life in these tropical lowlands, and one which profoundly impressed me as to future possibilities in this direction.

Part II.—General Ecology.

The Utinga water-works consisted of a pumping station from which radiated long open cement water-ways and closed pipes leading straight through the jungle. The light jungle began at the very edge of the small clearing which was within a few minutes' walk of the tram line leading directly back to the heart of the city.

It was without question quite the hottest, most humid tropical place I have ever encountered. I qualify with humid as I have known the dry heat of India to be much greater, as 110° F. at eleven P. M. at Agra. But this moist heat was in excess of any corresponding temperature I have known in Malaysia, Borneo, Mexico or elsewhere. It was the rainy season and the first day of our stay bore out the reputation of Pará for precipitation, the rain pouring down much of the day. During all of the remainder of our stay, the weather was ideal, clear until about 2:30 P. M., when dark clouds and wind came up, the rain continuing until 4 P. M. On only one day it rained for twenty minutes in the morning, with the afternoon shower as usual. The nights were, of course, cool.

Birds were most abundant from 8 to 10 A. M. and 2 to 5 P. M. while at mid-day, all songs and chirps ceased and only the occasional note of an insect broke the stillness.

Most of the birds had just passed the breeding season, and a goodly proportion of those secured were full-grown young. Both young and adults were molting or just completing the molt. In general they corresponded to our northern birds in August and September. A few, however, were preparing to nest and several were building. Blue tanagers had a nest a few yards from our house with two young which flew on May 8th. Yellow-backed caciques had several small colonies in isolated trees near native houses and were breeding.

Much of the land between the small streams or igarapés was marshy and covered with an almost impenetrable cover of undergrowth. Occasionally a slight rise resulted in dry ground and here the growth became higher, more open and assumed the general character of almost primitive tropical jungle. A narrow trail opened into jungle of this character only a few yards from our house in the pumping-station clearing. It led straight northwards for about two hundred yards when it ended in open, overgrown fields. Along this trail the undergrowth was fairly dense, with here and there a giant buttressed tree, surrounded by lesser trees of many species.

On the first tramp I took in the jungle I noticed a number of small birds in the upper branches of a tree which grew alongside of this trail. Not until I had passed that way several times did I come to realize that this particular tree had some powerful attraction for birds of many species. Knowing the shortness of time at my disposal I determined to concentrate my efforts on this tree which was a species of wild cinnamon. The present paper has to do chiefly with the facts thus obtained.

Once having our attention called to this bird tree, Mr. Hartley and I kept on the watch for others. Several hundred yards away along a pipe line we discovered another. It was a real giant, towering high above all the surrounding growth and we named it the toucan tree as it appeared to be especially attractive to these birds. It was covered with an abundance of good-sized scarlet fruit, the size of which accounted for the presence of medium and large birds such as toucans, caciques, trogons and kiskadees, instead of smaller callistes and flycatchers. A third berry-laden tree half a mile to the eastward straight through the jungle, bore oblong, yellow-skinned fruit appealing especially to woodpeckers and flycatchers, and from the brief glimpses we had as we passed, the constant abundance of birds would have furnished as interesting a list here as at the tree near our house.

I began my study of bird-life in the wild cinnamon tree by stealthy approaches, working my way through the jungle until I was close underneath. I soon found that this was quite unnecessary, as the birds among the upper branches paid no attention either to me or the sound of my gun. Three hours of constant observation beneath the tree resulted in many hours of pain from strained neck muscles. On the third day I brought out a canvas steamer chair and placing it in the trail at a convenient spot, found it to be ideal for observation. I could recline so that looking straight upward was no effort. With gun on my knees, glasses around my neck, note-book and dead birds on a stump within reach, I had discovered a truly *de luxe* method of tropical bird study. The biting flies, gnats and mosquitos made it impossible to sit absolutely quiet for more than a minute, and the ants soon found the legs of the chair gave easy access

to one's person. On the whole, however, I was too much absorbed in the novelty of the method of work and its unexpected results to give any thought to these annoyances.

The principal jungle bloom was the heliconias, whose scarlet, jagged spikes glowed brightly against the dark foliage. Variegated leaves were abundant and when the slanting sun struck through the jungle, it often appeared vivid with color. The jungle about my seat was, of course, more or less impoverished by the nearness of the city and the presence of the waterworks. Black capuchin monkeys of more than one species were hereabouts and I saw as many as nine in a band. Three-toed sloths were common as were agoutis and small squirrels. But during my periods of watching no mammal came near the tree.

The more frequent sounds were the common ones of light jungle, Tinamou called and answered one another, gold-birds lifted their wonderful voices far away in the forest, toucans yelped, caciques squeaked and gurgled overhead, cicadas shrilled and buzzed and great bees and hummingbirds whirred past. The commonest cicada had a note like a person calling a cat *puss-puss-puss* kept up interminably in a high soprano. Another had a shrill, strident note which, when it gained full strength, quavered and broke into two alternating tones, which finally ran together into a true trill. After the daily rain, the tiniest of frogs would each strike up a single, shrill note, unceasingly reiterated. The most memorable sounds were the deep, gutteral voices of great frogs hidden in the igarapés, who reiterated the never answered syllable, wh——y? wh——y?

My business was chiefly with the birds which I could observe from my canvas seat. I spent from two to six hours each day for a period of one week in the immediate vicinity of the tree and during that time identified ninety-seven species of birds, none of which were more than a few yards from the trail. A further division of these is as follows:

Aerial species flying overhead	7
Birds of the surrounding jungle	14
Birds observed in the tree	76

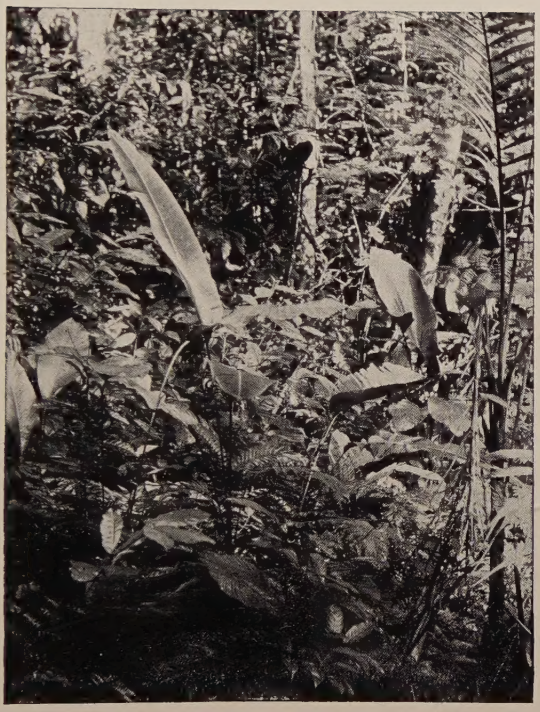


FIG. 13. UTINGA JUNGLE FOREGROUND

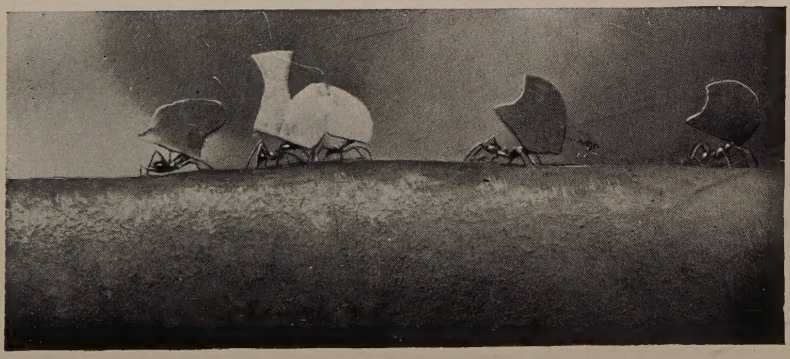


FIG. 14. PARASOL ANTS ON THE MARCH

I shall reserve the details of the various species until later pages, and here give only a résumé of the more general points of interest.

Of the seven aerial species, one was a vulture, one a nighthawk, one a swift and four were swallows. These all came into view at one time or another across the patch of sky visible beyond the upper branches of the tree. Now and then birds of prey appeared, but at such great elevations that I was unable to identify them.

The fourteen birds of the surrounding jungle may be divided thus: one tinamou, dove, woodpecker, kingfisher, trogon, ani and woodhewer, two antbirds, two flycatchers and three finches. In one or two instances these were birds of adjoining fields which had strayed a little way into the undergrowth. The majority, however, were typical of the lower jungle strata, either terrestrial or living in the low undergrowth.

This series of strata of bird life visible to me as I sat quietly hour after hour was very striking, a phenomenon which would never come to one while moving about through the jungle. Bound to the ground were the tinamou, and almost as terrestrial were the rustling ground doves. In the lower underbrush finches, *Synallaxis* and antbirds moved restlessly; a little higher manakins whirred about and woodhewers hitched up the trunks. Then came the birds of the upper branches, callistes, tanagers, flycatchers, toucans and parrakeets. Then the low flyers—the swallows, martins, swifts and nighthawks, and finally the vultures, hanging like the faintest of motes in the sunlight high above the earth.

Part III.—Canella Do Matto and Its Bird Life.

The tree which I have already mentioned grew only about one hundred yards from our house at the pumping station and within five minutes' walk of the Pará tram line. It was at the side of a jungle trail, which, while seldom traversed by natives, was kept clear of vegetation by the workmen at the pumping station. It was smooth-barked, richly decorated with lichens and while only about fifteen inches in diameter at a man's height

above the ground, it was very tall in proportion. The first branches were small, mostly dead and about fifty or sixty feet up. From this point the trunk split into lesser divisions and lifted its topmost foliage into the full tropical light and heat a hundred and ten feet above the ground. The berries were small, round and three-parted and, like the leaves, slightly acrid, with a spicy, aromatic flavor.

A few minutes after dawn I have counted eight birds in the tree and a half dozen would sometimes linger until dusk. As a rule, however, there were few in sight until 7:30 or 8:00 A. M., after which there would be a continual coming and going until the heat of mid-day drove all to shelter. The larger number of afternoon visitors came after the rain was over. Sunshine had much to do with the presence of the birds, and a cloudy half-hour meant but scanty notes as I sat beneath. With the reappearing of the sun, the birds would again begin to flock from the surrounding jungle.

Abundance of species and relative fewness of individuals is a pronounced characteristic of any tropical fauna. This was beautifully shown by my first two days' collection from the tree, collecting too, which was quite indiscriminate in character, very different from the more careful picking and choosing with which I shot on succeeding days. The first day I secured sixteen birds, all of different species. The second morning I got fourteen, all different, and only one of which was represented in the lot of the previous day. Thus in five hours' time I secured thirty specimens of twenty-nine species. From the entire district of Pará, three hundred and seventy-nine birds have been recorded. In this single tree within a week's time and during a period of intermittent observation I found seventy-six species.

The bird visitors to the tree arrived in one of two characteristic ways. Many came direct and swiftly, singly or in pairs, flying straight and with decision as if from a distance. A hundred yards away in any direction this convergence could frequently be observed, small birds flying over the summit of the jungle revealing a general flight direction treeward. Another method of arrival was wholly casual, loose flocks drifting slowly from the neighboring jungle, sifting into the tree and feeding

FIG. 15. GIANT LAND SNAIL

FIG. 16. NEST OF SAÜBA ANTS

for a time before passing on. When these left it was rather hastily and in answer to the chirps and calls of the members of their flock who had not been beguiled by the berries of this tree and hence had forged steadily ahead.

These more or less well-defined flocks are very typical of all tropical jungles. Little assemblages of flycatchers, callistes, tanagers, antbirds, manakins, woodhewers and woodpeckers are drawn together by some intangible but very social instinct, and unite day after day in these fragile fraternities which drift along, gleaning from leaves, flowers, branches, trunks or ground, each bird according to its structure and way of life. They are so held together by an invisible gregarious instinct that day after day the same heterogeneous flock may be observed, identifiable by peculiarities of one or several of its members. The only recognizable bond is vocal—a constant low calling; half unconscious, absent-minded little signals which keep the members in touch with one another, spurring on the laggards, retarding the over-swift.

At first I found it almost impossible to identify birds unless they were on the lower branches or silhouetted against patches of foliage. When in the upper branches and seen against the sky, birds with under-parts of black, blue or green all looked black. White under plumage appeared grey and buff seemed orange. Even when the tree was filled with the most brilliant callistes, not a bird was visible as long as they were motionless, but when the smallest, most drab of flycatchers moved head or tail I could at once detect it, and distinguish it from the moving leaves about it. Gradually I came to know all the more common species, beginning with the tail-flirting silver-beak tanagers, and before the end of my week's vigil, I seldom made the mistake of shooting a species with which I was already familiar.

While I watched, there came to my tree one species of pigeon, two hawks and two parrots, four hummingbirds and an equal number of toucans and woodpeckers. Fifty-nine were passerine birds of which there were eight each of the families of flycatchers, manakins and cotingas, and eleven tanagers.

Besides the seventy-six species which I positively identified by shooting or observation, I saw at least thirty-three more which eluded me, and of which a hasty glance told no more than that they were of new, and to me, unknown species.

The following is a list of the birds observed actually in the Canella do Matto tree.

COLUMBIFORMES 1

Splendid Pigeon, *Columba speciosa* Gmel.

ACCIPITRIFORMES 2

Brazilian Black Eagle, *Urubitinga urubitinga* (Gmel.).

Plumbeous Kite, *Ictinia plumbea* (Gmel).

PSITTACIFORMES 2

Tuipara Parrakeet, *Brotogeris tuipara* (Gmel.).

Dusky Parrot, *Pionus fuscus* (Müll.).

CORACIIFORMES

TROCHILIDAE 4

Red-vented Hermit, *Phaethornis ruber ruber* (Linn.).

Great Jacobin Hummingbird, *Florisuga mellivora mellivora* (Linn.).

Amazonian Wood-Nymph, *Thalurania furcata furcatoides* Gould.

Green-breasted Fairy, *Heliothrix auriculata phainolaema* Gould.

SCANSORES

RAMPHASTIDAE 4

Red-billed Toucan, *Ramphastos monilis* Müll.

Double-collared Aracari, *Pteroglossus bitorquatus bitorquatus* Vig.

Lettered Aracari, *Pteroglossus inscriptus inscriptus* Swains.

Gould's Toucanet, *Selenidera maculirostris gouldii* (Natt.).

PICIFORMES

PICIDAE 4

Spix's Amazonian Woodpecker, *Celeus jumana jumana* (Spix).

Waved Woodpecker, *Celeus undatus multifasciatus* (Mahl.).

Malherbe's Black Woodpecker, *Campephilus trachelopyrus* (Malh.).

Amazonian Gold-fronted Piculet, *Picumnus aurifrons* Belz.

PASSERIFORMES 59

FORMICARIIDAE 1

Sclater's Amazonian Bush-Shrike, *Thamnophilus amazonicus* Scl.

DENDROCOLAPTIDAE 7

Whiskered Recurved-Bill, *Xenops genibarbis genibarbis* Ill.

Wedge-billed Woodhewer, *Glyphorhynchus cuneatus cuneatus* (Licht.).

Eyton's Fulvous-throated Woodhewer, *Xiphorhynchus guttatus eytoni* (Scl.).

Chestnut-rumped Woodhewer, *Xiphorhynchus pardalotus* (Vieill.).

Picine Woodhewer, *Dendroplex picus picus* (Gmel.).

Layard's Woodhewer, *Picolaptes layardi* Scl.

Buffon's Barred Woodhewer, *Dendrocolaptes certhia certhia* (Bodd.).

TYRANNIDAE 8

Sulphury Flatbill, *Rhynchocyclus sulphurescens* (Spix).

Sclater's Flatbill, *Rhynchocyclus poliocephalus sclateri* Hellm.

Oily Flycatcher, *Mionectes oleagineus oleagineus* (Licht.).

Sharp-billed Flycatcher, *Tyranniscus acer* (Scl. and God.).

Yellow-vented Crested Flycatcher, *Elaenia flavogaster flavogaster* (Thunb.).

Gaimard's Crested Flycatcher, *Elaenia gaimardii guianensis* Berl.

D'Orbigny's Black-headed Flycatcher, *Myiarchus tuberculifer* (Lafr. and D'Orb.).

Azara's Flycatcher, *Empidonomus varius* (Vieill.).

PIPRIDAE 8

Banded-tailed Manakin, *Pipra fasciicauda* Hellm.

Red-headed Manakin, *Pipra erythrocephala rubrocapilla* Temm.

Slate-breasted Black Manakin, *Pipra leucocilla bahiae* Ridgw.

Orange-bellied Manakin, *Pipra suavissima* Sol. and God.

Pará Opal-crowned Manakin, *Pipra opalizans* Pelz.

Schomburgk's Manakin, *Piprites chlorion* (Cab.).

Blue-backed Manakin, *Chiroxiphia pareola pareola* (Linn.).

Eastern White-breasted Manakin, *Chiromachaeris manacus purus* Bangs.

COTINGIDAE 8

Cayenne Tityra, *Tityra cayana* (Linn.).

Red-cheeked Tityra, *Tityra inquisitor erythrogenys* (Selby).

Little Psaris, *Platypsaris minor* (Less.).

Cinereous Thickbill, *Pachyrhamphus rufus* (Bodd.).

Lichtenstein's Thickbill, *Pachyrhamphus marginatus* (Licht.).

Gold Bird, *Lathria cinerea* (Vieill.).

Schomburgk's Attila, *Attila brasiliensis* (Less.).

Cayenne Chatterer, *Cotinga cayana* (Linn.).

TROGLODYTIDAE 2

Swainson's Moustached Wren, *Thryothorus genibarbis genibarbis* Swains.

Venezuelan House Wren, *Troglodytes musculus clarus* Berl. and Hart.

TURDIDAE 1

Cabanis's White-throated Thrush, *Planesticus phaeopygus phaeopygus* (Cab.).

VIREONIDAE 3

Chivi Vireo, *Vireo chivi* (Vieill.).

Grey-naped Wood Vireo, *Pachysylvia thoracica semicinerea* (Scl. and Sal.).

Guiana Vireo-Shrike, *Cyclarhis gujanensis gujanensis* (Gmel.).

FRINGILLIDAE 2

Rothschild's Blue Grosbeak, *Cyanocompsa rothschildii* (Bartl.).

Great Saltator, *Saltator maximus* (Müll.).

COEREBIDAE 5

Brazilian Flowerpecker, *Coereba chloropyga chloropyga* (Cab.).

Turquoise Honey-Creeper, *Dacnis cayana cayana* (Linn.).

Black-backed Honey-Creeper, *Dacnis angelica angelica* Bonap.

Blue Honey-Creeper, *Cyanerpes cyaneus cyaneus* (Linn.).

Green Honey-Creeper, *Chlorophanes spiza spiza* (Linn.).

TANAGRIDAE 11

Blue-backed Green Tanager, *Chlorophonia chlorocapilla* (Shaw).

Northern Violet Euphonia, *Tanagra violacea lichtensteinii* (Cab.).

Cayenne Euphonia, *Tanagra cayennensis* (Gmel.).

Pará Blue-bellied Tanager, *Tanagrella velia signata* Hellm.

Spotted Tanager, *Tangara punctata punctata* (Linn.).

White-shouldered Blue Tanager, *Thraupis episcopus episcopus* (Linn.).

Palm Tanager, *Thraupis palmarum palmarum* (Wied.).

Silver-beaked Tanager, *Ramphocelus carbo carbo* (Pall.).

Scarlet-crested Tanager, *Tachyphonus cristatus brunneus* (Spix).

Pará Crested Tanager, *Tachyphonus surinamus insignis* Hellm.

Guira Tanager, *Hemithraupis guira guira* (Linn.).

ICTERIDAE 3

Great Green Cacipue, *Ostinops viridis* (Müll.).

Yellow-backed Cacique, *Cacicus cela* (Linn.).

Brazilian Red-rumped Cacique, *Cacicus haemorrhous haemorrhous* (Linn.).

The great abundance of birds in this particular tree was due, of course, to the multitude of ripe berries among its foliage. These were the primary cause of attraction. Lacking these, the

birds would have had no special reason for visiting it more than the surrounding jungle. And it was surprising to discover how many of the birds which would usually be considered as fly-catching or insect eaters, had in this case turned frugivorous. It seems worth while to reclassify this arboreal avifauna by the *raison d'être* of their presence.

Feeding on tree berries

Pigeon, 1
Parrakeet, 1
Toucanets, 3
Woodpecker, 1
Flycatchers, 8
Manakins, 6
Cotingas, 7
Thrush, 1
Vireos, 3
Finch, 1
Honey-Creepers, 5
Tanagers, 11
Caciques, 3

Snail-eater

Hawk, 1

Insect-eaters of the trunk

Woodpeckers, 2
Woodhewers, 7

Insect-eater of the branches

Wren, 1

Casual Visitors

Hawk, 1
Parrot, 1
Hummingbirds, 4
Toucan, 1
Woodpecker, 1
Bush-Shrike, 1
Manakins, 2
Cotinga, 1
Wren, 1
Finch, 1

The greedy, noisy parrakeets were restless jungle birds, shifting from one feeding place to another, always gorging themselves, tearing off bunches of berries and wasting much more than they ate. Of the members of the Ramphastidae, the visitors to this tree were almost wholly toucanets, the smaller, more agile species which found less trouble perching on the rather slender branches. The toucan tree a few hundred yards away, hung its larger fruit on stouter branches and attracted the toucans of larger size.

Without exception all the flycatchers which I observed in the tree—eight species—were feeding on the berries, in spite of their wide gapes and insect-guiding bristles. This was not so surprising in the case of the six manakins and seven cotingas, but the three vireos and five honey-creepers must have been birds of originality to turn thus wholly frugivorous. The tanagers led all in numbers, eleven of them, and were feeding exclusively on the berries, and the same was true of the three caciques.

On the casual visitors it is unnecessary to remark. A wren hunted insects among the upper branches one day, and on another a hawk found a giant snail crawling up the trunk and proceeded to devour it.

The insect-eaters of the trunk were nine in number and showed no interest in the berry harvest. Two were woodpeckers and there were seven species of that interesting tropical family of woodhewers. These birds were abundant at Utinga. Their labor was confined to a careful search for insects on the trunk and larger branches. The smaller woodhewers such as *Xenops* and *Glyphorhynchus* usually drifted to the tree as members of the loose jungle flocks. The larger woodhewers were more independent, and usually seen singly or in pairs. The low, plaintive notes of the little wedge-billed woodhewer were typically like those of the loose flocks, keeping the members in touch with one another.

Woodhewers are the very essence of protective coloring, and their habits of life make of them wandering bits of loose bark, yet because of their constant motion, they are very easy to see even in the dim light of the under jungle. The moment they are quiet they vanish, and the keenest eye in the world could not recognize them. This similarity of dress is a remarkable feature of this whole family; big and little, short and long-tailed, with beaks blunt, sharp, straight, curved, thick or needle-thin. In these characters they differ, by these points they must know one another. But their pattern shows little variation. Their olives or browns almost invariably warm into rich foxy rufous on wings and tail, while over head and shoulders a shower of light streaks has fallen, bits of sunlight fixed in down.

And so came to a close my rambling observations on the bird life of this single Canella do Matto. Within the space of a week I had spent not more than twenty hours of neck-racked, vertical observation, shooting whenever necessary, holding up my glasses until my arms collapsed with fatigue. In return I had been able definitely to identify seventy-six species and to record the presence actually in the tree of at least one hundred.

In point of actual numbers I kept no sustained record, but during one vigil of two hours' length I counted four hundred and sixteen birds in the tree.

When I began I had no conception of such success and as I look back and realize the necessary desultory character of my observations, the list seems even more remarkable. Relay observation on the part of two or three watchers for a correspondingly greater length of time, or closer observation from a blind fixed in a nearby tree, would yield notes of incomparably greater thoroughness and value.

Part IV.—Notes on Some Invertebrates Near the Canella Do Matto.

I made no effort, during the short time at my disposal, to carry on any lines of observation, other than upon the avifauna of the one tree. Yet as I walked back and forth along the trail, or sat quietly during the rather rare periods when no birds were in sight, or rambled about in the surrounding jungle and along the overgrown igarapés, I made a few desultory notes on certain invertebrates of especial interest to me as forming the food of jungle birds.

The great land snail, *Strophocheilus oblongus* Müller, we saw now and then, partly hidden in crevices of bark, and early one morning I saw a plumbeous kite in the canella tree, holding the shell of one of these mollusks in his talons and devouring the inmate. The shells were strongly grained, and of a rich brown with salmon-colored mouth. An ordinary sized shell was about four or five inches in length, and when the mollusk was fully extended the whole organism reached seven and a half inches. On a tree-trunk leaning over an igarapé I counted fourteen of these mollusks crowded into one very shallow cavity.

I observed that spiders entered largely into the diet of the birds I examined and I was interested in watching the method of escape of several common species, whose webs were hung along the trail.

Acrosoma spinosa Linn., an exceedingly spiny, gaudy spider hung in the center of its web. Its scarlet, yellow and black coloring seemed to indicate an unsavory mouthful, and it was correspondingly slow to take alarm. Its large, round web was swung obliquely within a foot or two of the ground. At the center was a heart-shaped open space in which the spider hung by six legs, the other two being drawn back ready for action. The web slanted backward and the spider hung upside down, the brilliant colors of the upper side of the body being thus completely hidden. When the creature was alarmed, it dropped to the ground along a cable which it attached to the point of the heart-shaped space and paid out as it fell. The moment it touched land, it slipped under a leaf. If no further disturbance ensued it regained its courage in about three minutes, and climbed swiftly, winding in its cable and apparently swallowing it, as it went. When caught in the hand, it turned at once upon its back and feigned death.

A mottled, rectangular, rather flattened and much more toothsome appearing spider was *Epeira audax* Blk. Its lure was usually hung under a stump or a fallen sapling. When disturbed it invariably ran upward from the center of the web to the trunk, where it drew in its legs and squatted. In four instances its resting place was a bit of mossy or lichened bark, and although in full view, it merged perfectly with its surroundings. So perfectly, indeed, that the eye had to search carefully to rediscover it each time it sprinted to safety.

Epieira truncata Keys, was a smallish black spider, with yellowish-white markings on its back. It had still a third place of concealment. Wherever its web was hung, there was always some convenient leaf which the spider had half rolled up, tied fast with web and lined with silk. At the first sign of danger or when heavy rain fell, the architect rushed from the center of the web to the prepared sanctuary.

The commonest spider at Utinga, fat, round, black and beloved by birds was *Eriophora purpurascens*. Unlike all the others its point of vantage was not at the center of its web but in a

specially prepared den. The web was invariably hung between the leaves of some shrub. At one side, usually above the web and in full view, three leaves were drawn loosely together and fastened. Between these the spider waited for tell-tale web vibrations, and in such places inquisitive antbirds and jungle wrens found and devoured it.

One day a short distance from the tree I watched an indecisive bout between one of these spiders and a small but courageous wasp. The contest must have been going on for some time as about half the web was already destroyed. The spider had left its den and was clinging to the center of the slack structure. The wasp was exerting every effort to destroy the remaining two or three chief supporting cables. She would alight and chew them with all her might. After a few futile attempts, buzzing with rage, she would fly at the strand, seize it in her mandibles, and darting backward in midair, endeavor to snap it. Then she alighted on a nearby leaf and carefully cleaned feet, wings and head.

After such a rest she would turn her attention to the spider itself, buzzing around as closely as she dared, and making sudden rear attacks.

Eriophora was never off guard for a moment and raising his grasping feet he offered an invincible front. As the wasp was only a fourth of the size of the spider she dared do nothing more in the line of direct attack. It appeared that all her efforts were directed to cutting the spider down to the ground when she could probably have mastered him. He evidently did not dare to attempt to reach his leaf shelter, and remained quiet, guarding against attacks, swaying in his half demolished web. Before any dramatic crisis could develop, a heavy downpour of rain came on and drove both creatures to shelter.

Caterpillars were abundant at this season and remains of them were found in the stomachs of about one bird in every three. The most noticeable, however, were too well-armed to fear sudden death at the beaks of birds. One appeared on the

smooth bark of *Miconia*, like a great felted mass of long reddish hairs, each of which was a veritable barbed and stinging nettle. This larva has never been reared to maturity, but it is supposed to belong to the Limacodidae. These caterpillars climbed slowly up the trunks, making about ten feet an hour.

Another bizarre larva spent the day hidden on the under side of a banana frond, close to the midrib. It looked like a short, thick, arrow, notched posteriorly, with a rounded, blunt head fringed behind with a row of great spikes. The imago is the moth *Opsiphanes invires.*

A sphingine snake-head caterpillar of the genus *Maclorya* was seen once. It is unquestionably one of the most startling dénouements in nature to see this large, smooth, innocuous looking larva suddenly bend its head forward and down, and transform into a vivid representation of a serpent's head, even to the rapidly playing forked tongue.

The omnipresent saüba ants (*Atta* sp.) forced themselves on the attention of the most casual observer. All day long their interminable lines flowed back and forth from tree-tops to nest, conveying myriads of green leaf burdens. The single point which impressed itself upon me was the large number of ants getting free transportation. Every other leaf had from one to six ants of small size clinging to the swaying frond. Where the leaf was pliable and of large size they had all they could do to maintain their position as it was jerked along. These were doubtless some small form of the saüba citizenry but why the free transportation and what their function was I could not determine.

One of the most remarkable invertebrates which I observed was an aquatic hairy caterpillar. This was found in abundance in shallow pools and creeks. The first one which I saw seemed to be wriggling about in the throes of drowning, having, as I supposed, fallen from the overhanging foliage. I charitably scooped it out and set it to dry on a bit of palm leaf. It attempted to walk away, but in spite of the fact that much of its hairy coat dried at once, it staggered about, toppling over at each step and

appearing more at ease squirming about on its side. Some distance further on I saw a dozen more in an open pool and then, realizing my mistaken kindness, went back and restored the caterpillar to its strange element. It seems that this is the larva of a small moth appropriately named *Palustra,* which has assumed an aquatic life. It swims by vigorous wriggles and uncoilings, and occasionally, like a mosquito larva, comes to the surface. It is not known, however, whether it breathes directly from the surface, or from the air entangled in its hairy coat.

Part V.—Notes on the Molt of Some Pará Birds.

My recent study of the molt, and especially of the tail molt, of pheasants has seemed to yield something of value in dividing these birds into subfamilies.[1] While disclaiming any preconceived belief in the use of this character in other groups, I have nevertheless lost no opportunity to record whatever data I could find in regard to this phenomenon. I intend as rapidly as possible to examine molting birds of all orders and to place the results on record. With this in view I present the facts derived from sixteen species which I examined at Utinga, near Pará, in Brazil in the early part of May. Fragmentary as they are, they show nevertheless that differences exist. Whether these, in some cases, are of only specific distinction, or whether of generic or family value, only future, more extensive investigations can prove.

As regards wing molt, I found only two exceptions to the regular formula of the primaries molting regularly and successively from within out, and the secondaries molting from the outermost inward. In the cotinga, *Platypsaris minor,* the primary molt appeared to be 1-2-3-4-10-5-6-7-8-9. The secondaries had two modes of molt. From the outer to the 4th pair; then from the 5th pair inward and the 12th pair outward, meeting about the 8th pair.

A specimen of *Dacnis cayana cayana* showed a similar break in the secondary molt, molting in both wings inward from the outer pair, and outward from the 9th pair, meeting at the 5th or 6th pairs.

[1]Zoologica. Vol. I, No. 15, p. 265.

In attempting to work out tail molt from dried skins in the Museu Goeldi I was impressed with the difficulty of accurate observation. It is almost impossible to examine thoroughly the entire individual rectrices without damaging the appearance of the skin, and the dried sheaths which are so often the sole clue to recent growth, crumble at the first touch of the pliers.

To summarize at once my data taken from fresh, unskinned birds, I record the following types of tail molt:

Centripetal, from the outside in,

Ramphastidae (3)
Picidae (1)

Centrifugal, from the center out,

Dendrocolaptidae (2)
Vireonidae (1)
Tanagridae (3)

Other types of tail molt,

2, 3 > 1-4-5-6 Pipridae (2)

3 — 1-2-4-5-6 Cotingidae (1)

1 < 2-4, 3-5 Coerebidae (2)

Ramphastos osculans *Ramphastidae.*

Two individuals collected from the same flock, May 9, were in almost the same stage of tail molt.

Ten rectrices. Molt from outside in.
Specimen A. Central, 2nd and 3rd pairs, old, unshed.
4th pair, blood sheath of 28 mm.
5th pair, growing 98 mm.

Specimen B. Central, 2nd and 3rd pairs, old, unshed.
4th pair, growing 59 mm.
5th pair, growing 106 mm.

In both birds the mode of molt of the primaries traveling outward had reached the 5th pair. That of the secondaries moving inward, had caused the renewal of eight feathers.

Pteroglossus inscriptus — *Ramphastidae.*

Bird collected May 6th.
Ten rectrices. Molt from the outside in.
Central pair, just shed.
2nd pair, one-half grown, 44 mm.
3rd pair, growing, 84 mm.
4th and 5th pairs, new, full-grown.

Selenidera gouldii — *Ramphastidae.*

Birds shot May 1st.
Ten rectrices. Molt from the outside in.
Central and 2nd pairs, old, unshed.
3rd rectrice (left), just shed.
3rd rectrice (right), blood sheath, 4 mm.
4th and 5th pairs, new, full-grown.

Celeus undatus — *Picidae.*

Bird shot May 6th.
Twelve rectrices, ten functional, and an outer vestigial pair 20 mm. in length. Molt from the outside in.
Central and 2nd pairs, old, unshed.
3rd pair, blood sheath just appearing.
4th pair, growing, 36 mm.
5th pair, almost full-grown.
6th pair, full-grown.

Dendrocolaptes certhia — *Dendrocolaptidae.*

Bird collected May 8th.
Twelve rectrices. Molt from the center out.
Central pair, new, full-grown.
2nd pair, nearly grown 96 mm.
3rd pair, blood sheath, 16 mm.
4th, 5th and 6th pairs, old, unshed.

Picolaptes layardi *Dendrocolaptidae.*

Bird collected May 6th.

Twelve rectrices. Molt from the center out.

Central, 2nd and 3rd pairs, new, full-grown.
4th pair, one-half grown.
5th pair, blood sheath, 19 mm.
6th pair, old, unsheath.

Pipra leucocilla *Pipridae.*

Bird collected May 3rd.

Twelve rectrices. Molt nearly complete; probably like that of the following species.

Central, 2nd and 3rd pairs, new, full-grown
4th pair, nearly full-grown.
5th pair, one-half grown, 18 mm.
6th pair, one-third grown, 8 mm.

Pipra opalizans *Pipridae.*

Two individuals collected on May 8th and 9th.

Twelve rectrices. Molt about the same stage in both. The second and third pairs are shed first and simultaneously; next the central, and then in succession the 4th, 5th and 6th pairs. This unexpected type of molt received confirmation from the fact of its occurrence in two individuals shot on successive days, in different parts of the Utinga jungle.

Specimen A. Juvenile male (Fig. 17).

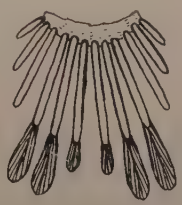


FIG. 17. TAIL OF MANAKIN

All twelve rectrices were blood sheaths, only the central, 2nd and 3rd pairs having broken through.

Central pair, 9 mm.
2nd pair, 11 mm.
3rd pair, 11 mm.
4th pair, 6 mm.
5th pair, 4 mm.
6th pair, 2 mm.

Both wings were exactly alike.

Primaries molting outward; 1st to 5th pairs new.
6th pair nearly grown.
7th pair three-quarters grown.
8th pair blood sheath, 7 mm.
9th and 10th pairs, old, unshed.

Secondaries molting inward; outer pair nearly grown.
2nd pair, blood sheath, 11 mm.
3rd pair, etc., old, unshed.

Specimen B. Adult male.

All twelve rectrices were blood sheaths, just breaking through. The sheaths all averaged 6 mm. in length.

Total Length	
Right	Left
11 mm.	—1st —11 mm.
14 mm.	—2nd—15 mm.
13 mm.	—3rd —14 mm.
11 mm.	—4th —12 mm.
7 mm.	—5th — 8.5 mm.
7 mm.	—6th — 8 mm.

In these specimens the very specialized, opalescent crest feathers were in full molt, almost all of them ensheathed. These sheaths were slender, conical, pointed and lightly fluted. The general appearance of the ensheathed crown feathers was of a mass of obliquely lying, parasitic cocoons on a caterpillar.

Platypsaris minor *Cotingidae.*

Bird collected May 8th.
Twelve rectrices, all old, unshed.

Wings in full molt, both wings the same. Old feathers rufous buff; new ones black, with white basal spots.

Primary molt 1-2-3-4-10-5-6-7-8-9.

Secondary molt, outer to 4th pair.
5th pair inward and 12th pair outward, meeting about the 8th.

Primaries, Inner, 2nd, 3rd and 4th pairs, new, full-grown.
5th pair, nearly full-grown 54 mm.
6th pair, just breaking sheath, 20 mm.
7th, 8th and 9th pairs, old rufous feathers.
10th pair, new, full-grown.

Secondaries, outer pair, nearly grown, 52 mm.
2nd pair, short sheath, 4 mm.
3rd and 4th pairs, old, rufous feathers.
5th, 6th and 7th pairs, new, full-grown.
8th pairs, short sheath, 8 mm.
9th pair, etc., new, full-grown.

Attila brasiliensis *Cotingidae.*

Bird collected May 1st, juvenile.

Twelve rectrices, molt apparently 3-1-2-4-5-6. Old feathers, worn, brown almost rufescent; new ones brownish black.

3rd pair, growing, 40 mm.
1st pair, growing, 21 mm.
2nd pair, blood sheath, 8 mm.
4th, 5th and 6th pairs, old, unshed.

Primaries molting outward, six pairs renewed.
Secondaries show no molt.

Cyclarhis gujaranensis *Vireonidae.*

Specimen A. Bird collected May 1st, female.

Twelve rectrices. Molt from the center out.

Outer four pairs, old, unshed.

Central pair, new full-grown.
2nd pair, growing.

No wing molt.

Specimen B. Bird collected May 1st, juvenile, female.

Twelve rectrices. All old except central pair which are nearly grown.

Dacnis cayana cayana *Coerebidae.*

Specimen A. Bird collected May 3rd, juvenile, female.

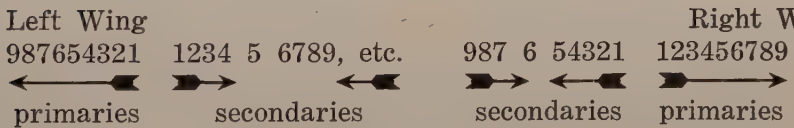
Ten rectrices. Molt 1 < 2-4 / 3-5

Central pair, new, full-grown, 36 mm.
2nd pair, 3rd pair } growing, 27 mm.
4th pair, 5th pair } blood sheath, 11 mm.

Specimen B. Bird collected May 5th, adult, male.

Tail has almost completed molt, outer pairs being nearly full-grown.

Wing molt three-quarters complete, showing an interesting and unusual type of secondary molt. Old feathers edged with green; new ones with blue.



Secondaries, right wing, outer, 2d, 3d and 4th, new, full-grown.
5th, blood sheath.
6th, old, unshed.
7th, still growing.
8th and 9th, new, full-grown.

left wing, outer, 2nd, 3rd and 4th, new, full-grown.
5th, old, unshed.
6th, blood sheath, 7 mm.
7th, blood sheath, 17 mm.
8th and 9th, new, full-grown.

Chlorophanes spiza *Coerebidae.*

Bird collected May 5th.

Ten rectrices. Molt 1 $\begin{cases} 2\text{-}4 \\ 3\text{-}5 \end{cases}$

Central pair new, full-grown.

2nd pair, 3rd pair } full grown
4th pair, 5th pair } old, unshed.

Thraupis episcopus episcopus *Tanagridae.*

Specimen A. Bird collected May 9th. Fledgling, male, first day after leaving nest.

Twelve rectrices well grown, and apparently of equal length.

Measurements

Fledgling		*Adult*
19 mm.—	Central	—64 mm.
23 mm.—	2nd	—65 mm.
23 mm.—	3rd	—65 mm.
25 mm.—	4th	—66 mm.
23 mm.—	5th	—66 mm.
21 mm.—	6th	—65 mm.

Specimen B. Bird collected May 1st, male.

Twelve rectrices. Molt from the center out. The whole web of the new feather is blue, stronger on the outer web. Old feathers are black on the inner web, greenish on the outer.

Central pair, new, full-grown.

2nd pair, still growing, 6 mm. shorter than 1st.
3rd pair, unbroken blood sheaths.
4th (right), sheath just appearing.
4th (left), not yet shed.
5th and 6th pairs, old, unshed.

Ramphocelus carbo carbo *Tanagridae.*

Specimen A. Bird collected May 1st, male.

Twelve rectrices. Molt from the center out.

Central and 2nd pairs, full-grown.
3rd and 4th pairs, just drying up.
5th and 6th pairs, not quite full-grown.

Specimen B. Bird collected May 5th, adult male.

Tail in full molt, from the center out.

Central and 2nd pairs, new, full-grown.
3rd, 4th, 5th and 6th pairs, all with 13 mm. sheaths, but total length steeply graduated.

Primaries molting outward, two outer pairs still growing.

Secondaries molting inward, three outer pairs full-grown, next three in active growth.

Tachyphonus surinamus insignis *Tanagridae.*

Specimen A. Bird collected May 2nd.

Twelve rectrices in full molt from the center out, with unusually long time hiatus between the central and 2nd pairs.

Central pair, new, full-grown, 72 mm.

Outer five pairs all with 11 mm. sheaths.

Total lengths 2nd pair, 69 mm.
3rd pair, 54 mm.
4th pair, 40 mm.
5th pair, 31 mm.
6th pair, 25 mm.

Wing molt nearly complete; primaries outward, secondaries inward.

Specimen B. Bird collected May 5th.
Tail completing molt from center out.

Part VI.—Annotated List of Birds Observed.

A. Birds of the Wild Cinnamon Tree.

Columba speciosa (Gmel.) Splendid Pigeon.

Three were observed on May 2nd, one in the tree feeding on the berries, the others on adjoining branches. They flew at once when I walked past beneath.

Urubitinga urubitinga (Gmel.). Brazilian Black Eagle.

Twice in the same day this bird visited the trail near the tree, once perching rather low in the jungle and remaining motionless. An hour later it returned and alighted on one of the lower branches of the tree itself, preening its feathers and paying no attention to the small birds scolding from the shelter of the thick foliage to which they had fled. A specimen secured had a large green, blue, red and yellow mantis with a hundred or more of its eggs in his crop.

Ictinia plumbea (Gmel.). Plumbeous Kite.

Early on May 11th at a time when there were only three or four small tanagers in the tree, this bird suddenly appeared. I had stopped watching for a few minutes to rest my fatigued muscles, and on looking up I saw this hawk perched in the tree on a branch, so slender that it was still swaying from the impact of his alighting. He seemed to be picking at something on the branch beside him, but flew at once when I fired, apparently quite uninjured by the small shot which I had to use. I then found that he had been devouring a snail of large size in its shell (*Strophocheilus oblongus*).

Brotogeris tuipara (Gmel.). TUIPARA PARRAKEET.

Quite common in families or small flocks. Twice observed in the tree feeding on the berries, and one which I secured had twenty-three in its crop. The noisiest birds hereabouts. While sitting at the foot of the tree, half an hour would seldom pass without a pair or more of these parrakeets dashing past high overhead, screeching loudly. Other trees seemed to offer more permanent attraction than this one. They showed little fear and members of their flocks could be shot one after the other without frightening the remainder. In the evening they collected in flocks of thirty or forty and circled about high in the air before setting off steadily south-westward toward some distant roost.

Pionus fuscus (Müll.). DUSKY PARROT.

A pair alighted in the tree on May 4th and remained for five minutes before flying off in the direction of the toucan tree. I heard them now and then in other parts of the jungle but did not again catch sight of one.

Phaethornis ruber ruber (Linn.). RED-VENTED HERMIT.

The most abundant hummingbird. Two females spent much of their time searching surrounding heliconia blossoms for tiny insects and resting from time to time on a lower branch of the tree.

Florisuga mellivora mellivora (Linn.). GREAT JACOBIN HUMMINGBIRD.

Thalurania furcata furcatoides Gould. AMAZONIAN WOOD-NYMPH.

Heliothrix auriculata phainolaema Gould. GREEN BREASTED FAIRY.

These three species of hummingbirds were observed perching in the tree on several occasions. Two others were not secured and could not be identified by the glass.

Ramphastos monilis Müll. Red-Billed Toucan.

In the cinnamon tree the visit of this large red-billed toucan was very evidently accidental as the berry-bearing branches were too slight to support his weight. I saw one on May 3rd, resting only for a moment before he flew on in the direction of the toucan tree. When the afternoon's rain was over, the yelping cries of these birds were the most conspicuous sound of the jungle.

Pteroglossus bitorquatus bitorquatus Vig. Double-Collared Aracari.

Twice observed in the cinnamon tree, and still oftener in the toucan tree. From a flock of eight secured two. Brilliant as these birds are, it is remarkable how easily they escape observation when in the tree-tops. Even when one of a flock is discovered, the closest scrutiny with powerful glasses fails to reveal the remainder, until one by one they move and betray their whereabouts. When motionless they resemble an irregular knot or bunch of leaves. When the broken stub of a branch contains water, they all visit it in turn, drinking after eating a half dozen or more berries.

Colors: iris pale yellow, with a antero-posterior extention of dark brown pigment, giving the pupil an elongated appearance. Bare skin around eye blue, lower lid orange yellow; facial skin same red color as feathers of nape; upper mandible lemon yellow, whitish near base and at tip, black along cutting edge; lower mandible black on terminal two-thirds, greenish-white near base and along ventral line; legs and feet yellow green like the flank feathers.

Pteroglossus inscriptus inscriptus Swains. Lettered Aracari.

An occasional visitor to the tree, and when a flock of them came, they made such a commotion that callistes and other small birds could hardly get a foothold. Four out of a flock of five were shot about fifty yards from the tree and the following day the survivor remained near, through most of the hours of day-

light, calling, and now and then feeding on the berries. The first bird shot was a young one and the rest actually followed it to within ten feet of where four of us were standing. Even after the third shot, the fourth bird came as boldly as ever in answer to the yells of the youngster. Bates and other writers speak of being mobbed by toucans in much the same manner.

Of the four birds, two were males, two females. The young molting male had the iris scarlet; crown above eye pale caerulean blue; eyelid, lores, beneath eye and around ear dark livid blue; broad line between eye and ear vermillion; skin back of nostrils bright blue; bill bright orange yellow and black; legs and feet sage green similar to the under tail web. The crop was filled with round, black seeds, which stained everything an indelible dark blue.

Selenidera maculirostris gouldii (Natt.). Gould's Toucanet.

The commonest toucan in the tree, observed on four separate occasions in pairs or trios, but remaining only for a short time and very wary. The iris is lemon yellow above and below, shading off in front and behind into green, which changes to black next the pupil, giving it an extremely flattened, elongate appearance; bill black and white, with the terminal parts of both mandibles pale green; facial skin yellowish and bluish green; legs and feet bluish-green.

Celeus jumana jumana (Spix). Spix's Amazonian Woodpecker.

On May 3rd a single bird hammered at a soft place in the bark of the tree for five minutes, then caught sight of me beneath and fled silently.

Celeus undatus multifasciatus (Malh.). Waved Woodpecker.

Observed by Cherrie in the tree on May 5th. Had been eating berries.

Campephilus trachelopyrus (Malh.). Malherbe's Black Woodpecker.

Late in the morning of May 6th a pair alighted on the trunk ten feet from the ground and worked their way upward to the small branches before flying off through the jungle. A female collected some distance away had the iris pale orange, bill greenish horn, darker along the culmen; legs and feet deep olive green. Crop filled with large yellow seeds.

Picumnus aurifrons Pelz. Amazonian Gold-Fronted Piculet.

While watching a flock of *Dacnis* in the tree early in May, I noticed three small birds which at first glance reminded me of nuthatches. I secured two and found they were curious soft-tailed woodpeckers or piculets. Whether they came for berries or in hope of insect food I cannot say and I did not again have opportunity to observe them. The third bird remained motionless in a neighboring tree for some time. Pará is a new locality for this group, but these individuals seem to be quite typical.

Thamnophilus amazonicus Scl. Sclater's Amazonian Bush-Shrike.

While having no real right in an arboreal fauna I must include this species, as a male bird flew up from the underbrush when I shot at it and missed, and alighted for a moment on one of the lower branches. With several other species it was not uncommon in the surrounding jungle.

A few yards from the tree a little earlier in the day, I had stalked the same individual in thick underbrush, where it seemed to be at odds with a white-breasted manakin. After the latter flew off, the Bush-Shrike kept constantly in one place, close to the ground, singing every thirty of forty seconds. It was a simple refrain *whut! whee-whee! whee-whee! whee-whee!* When startled it uttered the *whut!* alone. It was difficult stalking ground but only a loud crackle of leaves made the bush-shrike shift its perch. The female appeared for a moment and the male repeated his song twice very rapidly, and turning close

to her ruffled all his feathers, making himself into a perfect ball, blatantly displaying the usually concealed white patch, and with the spotted shoulders protruding conspicuously from the round, slate-colored mass. Keeping thus inflated he hopped around and around on his perch, completing a half turn at each hop, stopping for a second or two between hops and twisting so as to face her. At this time his song came irregularly. Twice he began it while on the hop, but did not end it. The moment the female slipped away, all his excitement ceased and he went hard at work on his never ending ditty. Once the shadow of a passing vulture fell upon him and cut short the refrain, but only for a moment. Great metallic bees buzzed close about the singer but were not noticed. I later found his crop crammed with small black ants.

Xenops genibarbis genibarbis Ill. WHISKERED RECURVED-BILL.

One seen on the tree, and once shot in the depths of the Utinga jungle.

Glyphorhynchus cuneatus cuneatus (Licht.). WEDGE-BILLED WOODHEWER.

The commonest woodhewer hereabouts, and observed almost every day on the tree, moving creeper-like up and around the trunk. The slightly upward curve of the beak gives to the bird a decidedly nuthatch profile. This species seemed about to nest and two females would have deposited eggs within a very few days. Its low, plaintive note often revealed its presence before it was seen.

Xiphorhynchus guttatus eytoni (Scl.). EYTON'S FULVOUS-THROATED WOODHEWER.

A pair of these large woodhewers were courting, a process which seemed to consist in the constant pursuit of one by the other. This took place along the trail on which the tree grew, and the birds alighted again and again in the tree but not to feed. After resting a moment, panting, they continued their endless

chase. They were silent and only when the pursuer almost caught up did the other utter a sharp, querulous note. So fast did they fly that the two brown bodies would appear like streaks shooting in and out of the tree-trunks. As they were seen in the trail every day their nesting site was doubtless not far off.

Xiphorhynchus pardalotus (Vieill.). CHESTNUT-RUMPED WOODHEWER.

Seen only once and secured from one of the higher branches of the tree.

Dendroplex picus picus (Gmel.). PICINE WOODHEWER.

Next to *Glyphorhynchus* the commonest woodhewer seen near the tree. Once only did one alight on it, but others were seen constantly on the adjoining trunks. Owing to the large amount of white it was the most conspicuous of these birds. Several times I saw one alight crossways on a branch, the first time I have ever seen a woodhewer assume this passerine position.

Picolaptes layardi Scl. LAYARD'S WOODHEWER.

Dendrocolaptes certhia certhia (Bodd.). BUFFON'S BARRED WOODHEWER.

I saw neither of these species but I examined specimens in the flesh shot from the tree by Mr. Cherrie in my absence.

Rhynchocyclus sulphurescens (Spix). SULPHURY FLATBILL.

Abundant in tree. A dozen could have been shot at each period of observation, had I wished them. An adult and a young male which were secured were both feeding on the tree berries. The latter was in very much worn juvenile plumage and about to moult.

Rhynchocyclus poliocephalus sclateri Hellm. SCLATER'S FLATBILL.

A male collected in the tree on May 10th had both tree berries and small Diptera in its crop.

Mionectes oleagineus oleagineus (Licht.). Oily Flycatcher.

This was the commonest flycatcher which frequented the tree. I secured six and could have shot twenty on any of the days when I was on watch. Its bright buff breast rendered it one of the easiest birds to recognize, and after a day's observation I shot none by accident. Their food consisted both of tree berries and small insects.

Tyranniscus acer (Scl. and God.). Sharp-Billed Flycatcher.

These little flycatchers were rather rare and usually early comers. I secured none after seven-thirty in the morning, and even then they had been feeding for some time. Those collected in the tree had fed altogether on the tree berries. They were breeding at this season. Even with my powerful field glasses, and with knowledge of the points of difference it was absolutely impossible to distinguish this species from either of the preceding forms of *Rhynchocyclus*. When eighty feet or more up, I do not think identification with glasses of these lesser flycatchers can be accomplished.

Elaenia flavogaster flavogaster (Thunb.). Yellow-Vented Crested Flycatcher.

Observed several times in the tree feeding on the berries. It kept lower down than the other smaller species and was recognizable by its clean-cut, white markings.

Elaenia gaimardii guianensis Berl. Gaimard's Crested Flycatcher.

Only among the top-most branches with other small Flycatchers. On two occasions when seen against a mass of dense foliage I detected the half-concealed, white crown, but usually the species merged wholly with the *Rhynchocyclus* and *Tyranniscus* feeding with it. It was feeding wholly on the tree berries.

Myiarchus tuberculifer (Lafr. and D'Orb.). D'Orbigny's Black-Headed Flycatcher.

This was the only species of flycatcher which ever got in the least excited over my presence at the foot of the tree. As I was getting into position for a prolonged period of observation, one or a pair of these birds would occasionally drop down from the upper branches and with crest raised, excitedly flutter from one branch to another uttering a continual sharp *tsip! tsip!* While the berries were eaten by all I examined, yet insects were never wholly absent, and more than once I saw birds of this species launch out high above the tree after passing insects. When seen against green foliage, even at a great height, the distinct areas of grey and yellow on the lower plumage were quite distinct.

Empidonomus varius (Vieill.). Azara's Flycatcher.

A specimen in worn plumage shot from the tree and three others near by. All must have been in the tree during the morning as all had tree berries in their crops.

Pipra fasciicauda Hellm. Banded-Tailed Manakin.

Several times I had watched orange and black manakins in the lower branches of the tree and supposed they were the common red-headed species (*Pipra rubricapilla*). It is very probable that most of them belonged to that species, as all which Cherrie and I secured in the neighborhood of Utinga were *rubricapilla*. The single bird which I secured from the tree was the banded-tailed manakin. In its crop were two small beetles and seven tree berries.

Pipra erythrocephala rubrocapilla Temm. Red-Headed Manakin.

The commonest manakin at Utinga. Early every morning a male would be perched on the same branch of the tree and

twice I saw him driven away by other manakins. He never fed while I watched him, but sat sometimes for fifteen minutes without moving, paying no attention even to the sound of the gun or of the shot as it returned and swished through the leaves after I had fired a shot straight upward.

Pipra leucocilla bahiae Ridgw. Slate-Breasted Black Manakin.

Next to the red-crowned this manakin was most frequently seen. It was a female of this species which, with a male opal-crowned manakin, I secured from the tree with one shot. They had united to chase away the red-crowned bird from his perch and at once had flown upward beyond the usual height at which these birds are found. In the upper branches they joined a small flock which had come out of the jungle, and which soon left the tree and went on toward the north.

Pipra suavissima Sol. and God. Orange-Bellied Manakin.

After a flock of roving jungle birds had left the tree I secured this specimen from their number. It had two tree berries and a great mass of insect larvae in its crop. I did not observe it again during my stay.

Pipra opalizans Pelz. Para Opal-Crowned Manakin.

The female which I secured was in an adjoining tree, but only about twenty feet from the cinnamon tree, and within half an hour the small flocks of manakins appeared from which I got the male bird. There were five berries in the crop, which otherwise was empty. A day or two before seven or eight of these beautiful birds had been secured for Mr. Cherrie two miles away, by a native collector. Aside from these examples we saw nothing of the species.

Piprites chlorion (Cab.). Schomburgk's Manakin.

Shooting at what I took to be a flycatcher of some new species I secured a female of this species from one of the lower

branches. It had been hopping about for some time in the neighboring jungle and its crop contained only small insects. It was quite alone and I saw nothing, nothing of its mate or of other individuals.

Chiroxiphia pareola pareola (Linn.). Blue-Backed Manakin.

Twice seen and one male secured. On May 5th a male had been flying back and forth for some time before I gave it careful attention. Although well above the ground, it showed its crown and back so distinctly that I knew it at once, and watched it through the glasses snatching berries and chasing some species of *Dacnis* through the branches.

Chiromachaeris manacus purus Bangs. Eastern White-Breasted Manakin.

Although a day seldom passed when I did not see this species near the tree, it was only on the last day of observation that I saw it actually in the tree itself. Two manakins of unknown species were having a most excited time in the lower branches and making all the noise of which they were capable. The uproar drew two male white-breasted manakins from the jungle undergrowth and they flew up without hesitation to see what the matter was. When they reached the branch the row soon ended and all concerned sought privacy again. A pair was always to be found about one hundred yards from the tree on the edge of the jungle where an old cultivated field had grown up to dense briery undergrowth. A second pair must have had a nest within ten or fifteen yards of the trail, although most careful search failed to locate it. While sitting quietly near the tree the female often came close and peered at me, hopping from twig to twig, and at each flight producing the characteristic deep, low *whirrrrrrrrr!* the wing song by which these little jungle people give vent to their emotions—courtship, suspicion, fear.

Tityra cayana (Linn.). Cayenne Tityra.

One of these birds perched for some time in a tree close to our house on the first day of our stay at Utinga. I saw no more

of the species until I found that late in the afternoon just after the rain or even while it was still falling, three of these tityras came to the tree regularly in company with one or two Cotingas. I saw them under these conditions on three separate occasions and watched them feeding on the berries at leisure.

Tityra inquisitor erythrogenys (Selby). Red-Cheeked Tityra.

One early in the morning of May 6th. Not seen again.

Platypsaris minor (Less.). Little Psaris.

At seven A. M. on May 6th the cinnamon tree seemed almost deserted. I arranged my canvas chair and lying back, searched the upper branches carefully with my glasses for signs of life. Suddenly I saw motion in the tip of what I had thought was a broken branch stub. Several minutes passed and as I could make nothing of it, I secured it and found it to be a female psaris. It had evidently been feeding elsewhere as well, as the stomach contained a large yellow seed and a green grasshopper, while in the crop were three tree berries.

Pachyrhamphus rufus (Bodd.). Cinereous Thickbill.

Twice I observed the unmistakable female of this species feeding in the tree, but was unable to secure it. On the following day we shot a specimen some distance away. Its only food was hairy caterpillars. It seems a silent, quiet bird, slow in movement and stupid in taking alarm at the warning cries or flight of other birds.

Pachyrhamphus marginatus (Licht). Lichtenstein's Thickbill.

Quite ignorant of what I was shooting at, I secured a female of this thickbill from the very top of the tree where it was feeding in company with callistes and flycatchers. It had breakfasted on a spider and several tree berries.

Lathria cinerea (Vieill.). Gold Bird.

The gold or greenheart birds as they are known in Guiana, were found in the Utinga jungle, isolated as usual, vague calling Voices, penetrating and ventriloqual. A great fig ten yards from my cinnamon tree was a favorite perch of one of these birds and twice or more each morning it came to the berry tree to snatch a mouthful of the fruit and dash back again. It would utter its call the moment it alighted, but I never heard it given elsewhere than from this perch in the dense heart of the great fig tree.

Attila brasiliensis (Less.). Schomburgk's Attila.

While observing this species and after I had secured a specimen I supposed I was dealing with some unknown form of flycatcher, although I had never known any member of the Tyrannidae with such a marvellous vocabulary as had these birds. Two individuals, one adult and a young male, were in the tree early on the morning of May 1st and ultimately I secured the latter and identified the species. They were exceedingly active and playful. The full-grown young bird would aproach its parent, fluttering its wings and begging for food, then being chased swiftly through the jungle and back again, or swinging around, would pursue the other in turn. The song, which was uttered every ten or fifteen seconds was exactly alike in the two birds. It was a high, liquid four note phrase, *wheedle-wheedle-wheedle-wheedle!* Four rapid repetitions was the rule, more rarely increased to five or six. But this was constantly varid from the more usual timbre. When uttered while in pursuit of one another it became higher and shriller, or when given as the overgrown youngster was swallowing a berry it was fairly gargled. Again only a single *whee!* would be uttered, standing for some unknown emotion. At least a score of variations or shades of utterance were heard in fifteen minutes. The note of suspicion or alarm, given when I made too loud a noise or when another bird or a squirrel alarmed them, was very different, a loud, sharp, woodpecker-like cackle. After this was uttered once or twice, during which time the birds were motionless, the wheedle call or song commenced, the Attilas becoming at once active.

They kept to the tree-tops and only by a quick, long-distance shot was I able to secure the young bird. The iris was pale hazel-brown; upper mandible horny black; lower also, with a large, fleshy-white patch mid-way along the rim on each side. The inner gape showed the loose yellow skin so characteristic of young birds; legs and feet slaty-blue; soles yellowish-flesh; claws dark brown.

The most unexpected fact was in connection with its food. The crop was full of berries and there were two which had not yet been swallowed, but in the gizzard were the recognizable remains of a small fish. The only way I can account for this unusual item of diet is that the birds must have been drinking at a jungle pool near by in which were many small minnow-like *Tetragonopterus*, and the young bird in some way had managed to seize and swallow one.

Cotinga cayana (Linn.). Cayenne Chatterer.

Once or twice these brilliant birds were seen in the mango trees near our house, but like the tityras I did not see them elsewhere than in the cinnamon tree in late afternoons. There were usually two, one in full color and the other a female or young bird. Their brilliance absolutely disappeared when seen against the bright sky, but in contrast with the green leaves or a cloud, lighted by the slanting rays of the sun, they flashed like great gems.

Thryothorus genibarbis genibarbis Swains. Swainson's Moustached Wren.

For two days in succession a pair of these birds remained in the neighborhood of the tree, occasionally visiting the lower branches, but only momentarily and, as far as I could judge not touching the berries, but intent only on insect prey. One made occasional attempts at song, but the season was evidently past or had not yet arrived.

Troglodytes musculus clarus Berl. and Hart. VENEZUELAN HOUSE WREN.

This is, of course, not a bird of the jungle and its presence in the tree was accidental, and as far as my observation went occurred only once. The bird seen was doubtless one of a pair which lived in and about the clearing about our house, and made deeper foraging inroads now and then into the jungle. It was probably the number and commotion of the small callistes and other birds feeding in the tree which drew the inquisitive wren thither early in the morning on May 6th.

Planesticus phaeopygus phaeopygus (Cab.). CABANIS'S WHITE-THROATED THRUSH.

Not uncommon in isolated pairs through the jungle, and an occasional visitor to the tree especially in late afternoons. They went about feeding in a business-like manner, apparently filling their crops in a short time. The nesting season for them had just begun.

Vireo chivi (Vieill.). CHIVI VIREO.

At 8 A. M. on May 5th I secured this bird from the upper branches of the tree, not knowing at what I was shooting except that it had a different carriage from the flycatchers and dacnis which thronged the upper foliage. Four tree berries were in its crop and a fifth still unswallowed in the mouth.

Pachysylvia thoracica semicinerea (Scl. and Sal.). GREY-NAPED WOOD VIREO.

Cyclarhis gujanensis gujanensis (Gmel.). GUIANA VIREO-SHRIKE.

I secured these birds within ten minutes of one another on May 2nd. Both were feeding on the berries of the tree.

The previous day we had shot elsewhere an adult male vireo-shrike and a young male of the year in very worn plumage. Comparison of these two showed the following differences:

	Adult	*Juvenile*
Length	147	143
Culmen	16	15
Culmen from nostril	10	9
Wing	70	65
Tail	55	55
Tarsus	20	21
Middle toe and claw	16	17

Bill: adult reddish horn; juvenile slaty grey; tips in both whitish.
Legs and feet: adult brownish blue; juvenile clear slaty blue.
Iris: adult reddish orange; juvenile hazel, paling outwardly.
Bare facial area: adult warm flesh; juvenile olive green.
Forehead: adult rich chestnut; juvenile grey like head.
Superciliary: adult rich chestnut; juvenile warm buff.

Cyanocompsa rothschildii (Bartl.). ROTHSCHILD'S BLUE GROSBEAK.

I saw this bird on two occasions feeding on the berries of the tree, although it was probably the same individual. The second time it descended to one of the lower branches and remained motionless for many minutes.

Saltator maximus (Müll.). GREAT SALTATOR.

Saw but one of this species in the tree and that quite an accidental visitor as it perched only for a few seconds on a lower limb and then flew straight off through the jungle. Two days later we secured a specimen a mile away, but saw no others during our stay.

Coereba chloropyga chloropyga (Cab.). BRAZILIAN FLOWERPECKER.

A few of these little birds were seen almost every day in the tree usually well up near the top, but unlike most of their

companions feeding apparently altogether on small insects. The first one which I saw in the tree was on a lower branch by itself, singing with all its might. Its song was sweet, rather short and of a wheezy character with a quaint little lilt. This in spite of the fact that it was in very worn, shabby breeding plumage.

Dacnis cayana cayana (Linn.). TURQUOISE HONEY-CREEPER.

These exquisite little birds were one of the most abundant species which frequented the tree. I saw at least fifty during each period of two or three hours of observation. All which I secured were feeding on the berries. They usually kept to the upper branches, flying swiftly from the surrounding jungle summits, and moving actively about, now and then catching an insect but preferring the tree berries. This was the only species of the Family which ever came down to lower branches. When well up it was impossible to differentiate between this and the next species. The color of the turquoise honey-creeper is remarkable. When the bird is held between the observer and the light, no matter how oriented, whether sideways, head or tail on, it is a deep cobalt blue; when looked at with the light behind the observer, it is as intense a clear, shining turquoise. There is no position of feather or bird which will alter these colors.

Dacnis angelica angelica Bonap. BLACK-BACKED HONEY-CREEPER.

Still more active than the turquoise, this bird equalled it in numbers, and sometimes twenty were in the top of the tree at one time.

Cyanerpes cyaneus cyaneus (Linn.). BLUE HONEY-CREEPER.

The blue honey-creeper, perhaps the most beautiful of all this group, was much more common at the tree in the afteroon than in the morning. I was able to identify the males of these birds at any height and found them in the proportion of two in the morning to seven in the afternoon. I have counted eighteen individuals at one time. They seldom descended to the lower branches. In every specimen I examined there were a few insects in the crop in addition to the tree berries.

Chlorophanes spiza spiza (Linn.). GREEN HONEY-CREEPER.

The fourth member of this group, glowing with its green iridescence in the sunlight. Instead of insects these birds were plucking tree berries with their long curved beaks. They seemed equally abundant, whether at daybreak or after the daily rains in late afternoon. Eight males and two females were grouped together on one of the central branches for fully five minutes one morning, excited about something which the most careful scrutiny with my glasses failed to reveal.

Chlorophonia chlorocapilla (Shaw). BLUE-BACKED GREEN TANAGER.

This bird which appears to be new to this part of Brazil was shot accidentally. I aimed at a blue-bellied tanager in the tree, missed it, and this small, wonderfully-colored species, which I had quite failed to observe, dropped from an upper branch. It had two tree berries in the crop.

Tanagra violacea lichtensteinii (Cab.). NORTHERN VIOLET EUPHONIA.

Never present in large numbers but several pairs were sure to turn up in the tree during the day. They did not remain long, perhaps, because a berry or two must have made a cropful for such diminutive chaps. No matter how busy hopping about, they always found time every few minutes to stop and burst into their jubilant little song.

Tanagra cayennensis (Gmel.). CAYENNE EUPHONIA.

Decidedly rare in the tree. Saw four and secured one. Easy to identify when not silhouetted against the sky, the two lateral patches of orange feathers standing out in strong contrast with the blue black of the remainder of the plumage. The specimen which I shot had small green seeds in its crop, not those of the tree.

Tanagrella velia signata Hellm. Pará Blue-Bellied Tanager.

On May 5th Cherrie shot a female of this beautiful bird from the tree and within five minutes I secured its mate. On three later occasions I observed this tanager, always in pairs and in the early morning. It could not be recognized with certainity in the upper branches as the yellow of the black was usually concealed. They fed greedily on the tree berries.

Tangara punctata punctata (Linn.). Spotted Tanager.

Early visitors to the tree, coming singly or in pairs straight across the top of the jungle as if from a distance. They knew the tree well and began to feed as soon as they arrived. After they had eaten several berries they would appear satiated and either sit in the sun and preen their feathers or chase one another about, always returning from the surrounding jungle for another period of feeding before they left.

Thraupis episcopus episcopus (Linn.). White-Shouldered Blue Tanager.

Blue tanagers were rare at the tree although common elsewhere, and when they appeared came singly or in pairs. I saw them there only three times. This may have been because they were nesting at this season, a pair of birds having a nest in a mango tree a few yards from our house. There were two young birds and these flew on May 8th.

Thraupis palmarum palmarum (Wied.). Palm Tanager.

One bird shot in the tree in company with a flock of silver-beaks on May 8th. Its mate fed for some time afterwards on the tree berries. Although fairly common elsewhere on the borders of the jungle no more were observed in the tree.

Ramphocelus carbo carbo (Pall.). Silver-Beaked Tanager.

The commonest bird at Utinga and almost constantly present in the tree. When large numbers of callistes and flycatchers were gathered together there would sometimes be only

one silver-beak. Then with a rustle of wings a whole flock would fly up from the surrounding jungle, twenty or thirty in all, and without actual aggression but by sheer numbers would disturb most of the smaller birds. They would chase other birds half playfully or in turn be pursued by some flycatcher, but on the whole the tree-top assemblage of birds was a peaceful one. The quickest glance served to identify these tanagers, for though their white beak might be invisible, and their plumage appear jet black viewed against the bright sky, the characteristic sideways flirting of the tail never failed. Their sharp metallic *chip!* was another positive factor of identification. They were restless, never remaining very long in the tree but flying off one after the other to work their way slowly through the jungle.

Tachyphonus cristatus brunneus (Spix). Scarlet-Crested Tanager.

One specimen with a number of honey-creepers was secured in the tree early on May 2nd. Did not note another during my stay.

Tachyphonus surinamus insignis Hellm. Pará Crested Tanager.

Three or four times I observed this bird at the tree feeding on the berries and secured two specimens. Its peculiar markings enabled me to identify it at almost any height. On May 5th a male suddenly swooped down from the upper branches and showed great agitation upon finding me in my observation chair. I soon discovered that the cause was a female and single young in the undergrowth near by, who were attracted rather than frightened by the emotion of the male. They soon took themselves off, and in a few minutes the male crested tanager was again back feeding in the tree.

Hemithraupis guira guira (Linn.). Guira Tanager.

Early on May 5th a pair of these birds high up in the tree. One of these I secured. The other continued feeding and flying about the tree with honey-creepers and flower-peckers for some time afterwards.

Ostinops viridis (Müll.). Great Green Cacique.

A small colony of these splendid birds was established near the toucan tree, to which tree they paid frequent visits. Only once did I see one in the cinnamon tree and then only for a minute. He snatched two berries, looked carefully about him, down at me and flew off through the jungle in the direction of the colony, a few hundred yards away.

Cacicus cela (Linn.). Yellow-Backed Cacique.

Five times I saw these birds in the tree feeding greedily on the berries. The slenderness of the branches seemed to bother them, however, and they never remained long. They constantly haunted the toucan tree several hundred yards away, which had larger berries and stouter branches. There were three separate colonies within the radius of a half mile, the nearest only a hundred yards from the tree and from our house in the yard of a native. In certain zones of the jungle the squeaks and gurgles of these birds were the dominant sounds throughout the day.

In spite of this indescribable squeaking and yelping, the yellow-backed caciques appear to have a consistent call or song. It may be written, *yank! yank! yank-keou-ke-wonk!*

Cacicus haemorrhous haemorrhous (Linn.). Brazilian Red-Rumped Cacique.

One individual was in the tree on May 6 with four yellow-backed birds. I could not secure it but watched it for more than five minutes.

B.—Aerial Birds.

Catharista atratus brasiliensis (Bonap.). Brazilian Black Vulture.

Five minutes seldom passed, hour after hour, when one or more of these birds did not soar across the bit of sky visible above the cinnamon tree. Usually they were very high up,

soaring, but occasionally just sweeping the tree tops with their pelican-like habit of alternate flapping and gliding. At sunset scores flew past southward, just clearing the jungle, or else collected on some dead tree until twenty or thirty had assembled, when all flew off in the same direction to some distant roost.

Chordeiles acutipennis acutipennis (Bodd.). South American Nighthawk.

Chaetura spinicauda spinicauda (Temm.). Spine-Tailed Swift.

Tachycineta albinenter (Bodd.). White-Vented Tree Swallow.

Progne chalybea chalybea (Gmel.). Grey-Breasted Martin.

Atticora fasciata (Gmel.). White-Banded Swallow.

Stelgidopteryx ruficollis ruficollis (Vieill.). Brazilian Rough-Winged Swallow.

The above six species were observed, the first in late afternoon and the others throughout the day, hawking about in the sky over the tree. None were very rare, the last named, perhaps, the most abundant. In clear weather they flew high, but as the clouds gathered they settled lower, following the shifting strata of volant insect life.

C.—Birds of the Surrounding Jungle.

Crypturus variegatus (Gmel.). Variegated Tinamou.

These tinamou were twice seen and heard daily within a few yards of the cinnamon tree. Their plaintive, sustained note was one of the commonest sounds of the jungle. They would reply to an imitation of their notes and even approach, but never close enough for a shot, and no especial effort was made to stalk them. The only specimen examined was one in the last stages of decomposition which had met its death a few feet from the cinnamon tree trail. It was being skeletonized by ants and there was left barely sufficient plumage for identification.

Geotrygon montana (Linn.). Red Ground Dove.

Not uncommon on the jungle floor, flushing with a loud noise of wings, and at first being confused with small tinamou. One which I secured showed no evidence of recent breeding.

Ceophloeus lineatus (Linn.). Great Lineated Woodpecker.

In late morning on May 9th as I sat watching under the cinnamon tree I was bothered for ten or fifteen minutes by what I thought were two men building a house. The hammering was loud and incessant, and I could tell when first one then the other began work as their boards gave forth varying tones. Often they would go at it together. Finally I heard a resounding rattle, more rapid and staccato than any hammering carpenter could produce, and my suspicion aroused, I walked to the end of the trail at the edge of the jungle. Out in a cleared field stood a headless, weatherbeaten royal palm and to this were clinging a pair of great lineated woodpeckers hammering intermittently and audible half a mile away.

Ceryle torquata torquata (Linn.). Great Grey Kingfisher.

On May 8th one of these splendid kingfishers passed over the tree on its way from one igarapé to another.

Trogon melanurus melanurus Swains. Black-Tailed Trogon.

The commonest Trogon hereabouts, more often heard than seen.

Crotophaga ani Linn. Common Ani.

Abundant in the surrounding brushy fields, but seldom venturing far into even the more open jungle.

Thamnophilus aethiopes incertus Pelz. Pelzeln's Bush-Shrike.

Not uncommonly seen and heard, and easy to recognize at sight after a specimen has been examined.

Cercomacra tyrannina Scl. TYRANT ANT-WREN.

A common species in the undergrowth of the jungle, frequently seen close to the base of the tree, hopping about or scratching among the dead leaves.

Synallaxis rutilans omissa Hart. PARÁ SPINETAIL.

A pair of these birds were nesting very close to the tree, and were never quite reconciled to my continued presence. Strangely enough, the occasional sound of the gun did not seem to alarm them. They kept rather low down, but five minutes seldom passed without one or the other coming to have a look at me, and voicing its dissatisfaction in a low *chut*. Specimens secured elsewhere showed that this species was both preparing to lay and brooding in early May.

Pipra aureola (Linn.). ORANGE-HEADED MANAKIN.

Not uncommon in the surrounding jungle, and I am almost certain that some of those in the tree itself were of this species.

Pitangus sulphuratus sulphuratus (Linn.). KISKADEE FLYCATCHER.

Conspicuous in appearance and vocally. An inhabitant of the open places but occasionally flying over or alighting on jungle near the tree.

Muscivora tyrannus (Linn.). FORK-TAILED FLYCATCHER.

This unmistakable species was seen several times flying over the tree.

Volatinia jacarini splendens (Vieill.). GLOSSY GRASSQUIT.

Common in the overgrown fields fifty yards beyond the tree at the edge of the jungle. Once a pair flew past down the trail headed for the pumping station clearing.

Brachyspiza capensis capensis (Müll.). CHINGOLO SONG SPARROW.

Heard singing in the nearest open glade and twice seen at the base of the tree.

Arremon silens (Bodd.). PECTORAL SPARROW.

These beautiful sparrows were not rare in the undergrowth at the base of the tree and as I was seated on watch, one or two would now and then flit across the trail with sharp chirps, coming back as closely as they dared to stare at me, hopping about nervously.

FAUNA OF FOUR SQUARE FEET OF JUNGLE DEBRIS

I.

For a week I had been studying the bird-life of a single tree, a Canella do Matto, as I have described in detail in the preceding number of ZOOLOGICA. On the last day as I was about to go, I concentrated my attention on the tree and the surrounding jungle, endeavoring to fix it indelibly in my mind. I realized that in a few minutes I would leave this place with which I had become so intimate, and should very probably never return. I had demonstrated a remarkable concentration of bird-life when attracted by the ripened fruit of a single jungle tree. It was the unparalleled insurgence of such a variety of organisms as can occur only in the tropics.

Now that there remained only a brief space of time I tried to conceive of some last thing I could do to re-emphasize this important phase of tropical life.

As I walked slowly up the trail toward the tree I heard a rustling among the leaves at one side, and in deep shadow beyond a dense clump of scarlet heliconias, I made out a tyrant antwren (*Cercomacra tyrannina*) scratching with all its might. To the kicking power of its small legs it occasionally added sudden flicks with the bill, given with such nice judgment and power, that it flung leaves larger than itself into the air and backward quite over its body. I had often wondered of what the food of these birds really consisted. Anyone could glance at the contents of a crop and gizzard and label it "small insects." But the actual details of this varied bill of fare, except in the case of very recently swallowed objects, was usually merged and lost in the comminuted mass of legs, elytra and antennae.

Acting on this hint I brought from my camping stores an empty war bag, and carefully scraped together a few handfuls of leaves, sticks, moss, earth and mold of all sorts. From directly under the Canella do Matto, I gathered four square feet of jungle debris, filled my bag and shouldered it. Then I said adieu to my trail and my tree, a sorrowful leave taking as is always my misfortune. For the bonds which bind me to a place or a person are not easily broken.

In this case, however, the bond was not altogether severed, and a week later when the sky line was unbroken by land, when a long ground swell waved but did not break the deep blue of the open sea, I unlaced my bag of jungle mold. Armed with forceps, lens and vials, I began my search. For days I had gazed upward; now my scrutiny was directed downward. With binoculars I had scanned without ceasing the myriad leaves of a great tree. Now with lens or naked eye I sought for signs of life on an infinitely smaller scale; the metropolis of a fallen leaf, the inhabitants of a dead twig. When I studied the tree-top life in the lofty jungle I was in a land of Brobdingnag; now I was verily a Gulliver in Lilliput. The cosmos in my war bag teemed with mystery as deep and as inviting as any in the jungle itself.

When I began work I knew little of what I should find. My vague thoughts visualized ants and worms, and especially I anticipated unearthing myriads of the unpleasant macuins, or bête rouge, whose hosts had done all in their power to make life in the jungle unhappy.

For ten days or more on the steamer trip north Mr. Hartley and I labored over the jungle debris. After two hours steady concentration our eyes rebelled and we had to desist. It seemed at times as if the four square feet had increased to forty, but the last handful was finally sifted and teased to shreds. Our method of work was to place a small pile on a newspaper spread on a table under the skylights of the smoking room, and with forceps and dissecting needle to search carefully every surface of leaf and frond and to split every twig and stem.

It was found that the safest way to capture the minute creatures which crawled or hopped about was to wet a small

brush in alcohol, touch them with the tip and float them off in the liquid in a very small vial. Thus they were uninjured and we could pick them from a mass of earth or fungus without including any of the debris itself. Usually we worked with our naked eyes, but occasionally hunted over a particularly rich field with low power dissecting lenses.

Day by day our vials increased. Scores of creatures evaded our search. Many others, of which I had captured a generous number, I allowed to escape. My lilliputian census was far from the mere aggregation of ants and worms which I had anticipated, and a review of the whole showed that hardly any great group of living creatures was unrepresented.

Two objects indicated the presence of wild mammals. First a bunch of rufous hairs which in size, color and minute structure were identical with those of the common agouti, which was very common at Utinga. I also found sign of this rodent. Man himself was represented by two wads which had dropped from my gun-shots sometime during the week. One had already begun to disintegrate, wet, half decayed and inhabited by half a dozen tiny organisms.

Five feathers were the marks of birds, also doubtless the result of my study during the week. A body feather, and two primaries from a sparrow-like bird were indeterminate, but two brilliant, green plumes came without question from the body of a calliste. Of reptiles there was a broken skull of some lizard, half disintegrated with a few of the teeth still left. There was besides the small egg-shell of a lizard which had hatched and gone forth to live its life elsewhere in the jungle. A third reptilian trace may have been his nemesis—a good-sized shred of snake-skin. The group of amphibians was present even in this small area of four square feet—a very tiny, dried, black and wholly unrecognizable little frog. Fishes were absent, although from my knees as I scraped up the debris, I could almost see a little igarapé in which dwelt scores of minnows.

As I delved deeper and examined the mold more carefully for the diminutive inhabitants, I found that this thin veneer from the floor of the jungle appeared to have several layers each with its particular fauna. The upper layer was composed of

recently fallen leaves, nuts, seeds and twigs, dry and quite fresh. As yet these showed but little change, and only the damage wrought by insects and other agencies while they were still on the trees. In this layer were small colonies of ants in hollow twigs and occasional huge solitary ones. Here lived in hiding small moths, beetles and bugs awaiting dusk to fly forth through the jungle. The lowest layer was one chiefly of matted, thready roots holding together compact masses of earthy soil, mixed with a large proportion of tiny bits of quartz. The animal life of this stratum was very meagre, occasional mites—especially red ones—and a few earth and round worms, the latter in much fewer numbers than in the middle layers.

Between the upper and the middle layers were sprouting nuts and seeds, with their blanched roots threaded downward into the rich dark mold, and the greening cotyledons curling upward toward light and warmth. Thus had the great Canella do Matto itself begun life. In my war bag were a score of potential forest giants doomed to a death in the salt ocean.

The middle layer, finally, was the all-important stratum. In it lived four-fifths of the small folk. This was composed of debris in full course of disintegration; leaves, sometimes partly green, usually brown or black, nuts half decayed, twigs half rotten. All still preserved their form, although some were ready to fall apart at a touch. All were soaked through, or at least damp and soggy. Often four or five leaves would be stuck together, stitched with the threads of fungi. In such a haven was always a host of living organisms.

Some of the half decayed leaves were very beautiful. Vistas of pale, bleached fungus lace trailed over the rich mahogany colored tissues, studded here and there with bits of glistening, transparent quartz. Here I had many hints of a world of life beyond the power of the unaided eye. And here too the grosser fauna scrambled, hopped or wriggled. Everywhere were tiny chrysalids and cocoons, many empty. Now and then a plaque of eggs, almost microscopic, showed veriest pin-pricks where still more minute parasites had made their escape. Contracting the field of vision to this world where leaves were fields and fungi loomed as forests, competition, the tragedies, the mystery

lessen not at all. Minute seeds mimicked small beetles in shape and in exquisite tracery of patterns; small beetles curled up and to the eye became minute seeds of beautiful design. Bits of bark simulated insects, a patch of fungus seemed a worm, and in their turn insects and worms became transmuted optically into immobile vegetation. Scores of little creatures were wholly invisible until they moved. Here and there I discovered a lifeless boulder of emerald or turquoise—the metallic cuirass of some long dead beetle.

Some of the scenes which appeared as I picked over the mold, unfolded suddenly after an upheaval of debris, were startling. When we had worked with the lens for many minutes, all relative comparisons with the surrounding world were lost. Instead of looking down from on high, a being apart, with titanic brush of bristles ready to capture the fiercest of these jungle creatures, I, like Alice in Wonderland, felt myself growing smaller, becoming an onlooker, perhaps hiding behind a tiny leaf or twig. This feeling became more and more real as we labored day after day, and it added greatly to the interest and excitement. Close by would appear, under the lens, piles of great logs and branches protruding from a heaped up bank of precious stones. Mauve, yellow, orange and cerulean hues played over the scene. Over a steep hill came a horned, ungainly creature with huge proboscis and eight legs, and shining, liver-colored body, all paunch, spotted with a sickly hue of yellow. It was studded with short, stiff bristles, and was apparently as large as a wart hog and much more ugly. It was a mite, one of the biting mites of the tropics, but under the lens a terrible monster. We put one of these on our arm to see if its bite corresponded to that of the legions of macuins which tortured us daily in the jungle. Under the lens I saw the hideous creature stop in its awkward progress and as it prepared to sink its proboscis we involuntarily flinched, so fearful a thing seemed about to happen.

In the middle layer, that of most active change, and surcharged with life, ants were abundant, together with small colonies of termites. These were the only social insects, the twigfuls consisting of from five to fifteen members. All the

other organisms were isolated, scattered here and there. Life in these lowly places, so far beneath the sunlight, is an individual thing. Flocks and swarms are unknown, and the mob has no place here. Each organism must live its life and fulfil its destiny single-handed. Even when two individuals were found together it was apparently more through accident of environment than from any gregarious instinct. In fact the same tropical law which holds good in regard to plants and the larger creatures of the sunlighted world overhead applies here. I found numbers of different species, but very few collections of individuals of the same kind.

Flatworms were rather rare, but small, white ones were found now and then flowing slowly along in their characteristic manner over the surface of damp, half decayed leaves, as flatworms do the world over. Roundworms, small, white and threadlike were present in equally small numbers. Earthworms of small size, one or two inches in length, were common. They moved slowly along in orthodox angleworm fashion until something alarmed them when they instantly became a maze of twisting, snapping curves, dancing all about in a most unwormlike fashion. The head and especially the collar were brightly colored, from reddish to an intense scarlet.

Centipedes and millipedes were common, all small, in keeping with the diminutive size of the other inhabitants of this little world. The largest centipede was less than an inch in length and scurried along on eighty-four legs. Very few were dark colored. Almost all were dead white, with yellowish brown heads and jaws. The larger millipedes were slow moving in spite of their abundance of feet, but small ones of various species were very agile, and slipped in and out of fungi forests in a most disconcerting way. They were about evenly divided between the groups of Polydesmoidea, Julioidea and Gerphiloidea.

Scorpions were decidedly rare, and two small and one medium sized specimen were all we could discover. Pseudoscorpions, however, were abundant and conspicuous. I secured fifty, and could have taken three or four times as many. They would rush out excitedly when disturbed, and unlike all the other creatures of the underworld did not seek to hide. Instead,

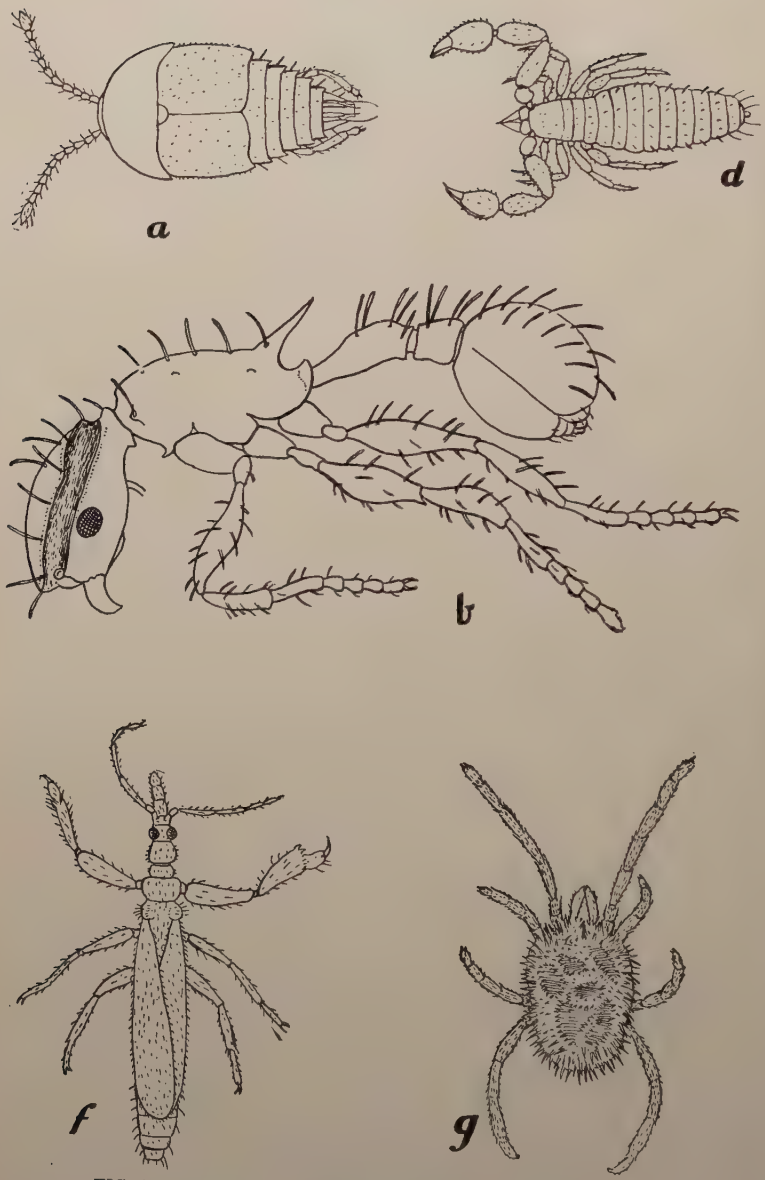


FIG. 18. REMARKABLE INSECT FORMS, CHIEFLY NEW
Found in the surface of a Tropical Yard of Jungle.

a, An unknown form, beetle, roach or cricket. *b*, The worker of a new genus and species of ant, *Blepharidatta brasiliensis* Wheeler, an extraordinary form, with small-eyed workers fitted for a subterranean life. The general structure is very simple and primitive. *d*. Pseudoscorpion, or false scorpion, a member of a compact, widely distributed family of Arachnida, with a pronounced superficial resemblance to true scorpions. *f*, Unknown, even as to order. *g*, A mite, one of the vast host of *bete rouge*, or maquins, the most troublesome pests of tropical jungles.

they bravely sought open spaces, walking slowly and feeling ahead with their great pincer-tipped arms, which they brandished with the greatest ease, although these weapons were as long as their entire bodies. When really alarmed, they scurried backward, holding up their chelae in readiness. Their bodies were whitish, but their arms and pincers deep reddish brown. While there were several species, these superficially fell into two distinct types. The most abundant kind was pot-bellied, with heavy chelae, and was slow in movement. The other had a narrow, lighter body and very delicate slender chelae, and ran with great speed when alarmed. These, however, always ran forward, not backward like the others.

Harvest men were represented by a single daddy-long-legs which looked decidedly out of place among this dense debris. I rather fancy he was strolling on the surface when my onslaught bagged him and his surroundings.

Very small and very pale colored spiders lived in the middle layer in fair numbers. We saw about two score altogether. They were usually slow or moderately gaited, like their more abundant relatives, the mites. Only twice did we see a spider dash off with any of the speed which characterized those which lived in the jungle above ground.

Next to the ants the mites and ticks were the most abundant organisms. Hardly a leaf or bit of mold was free from them. We could have gathered hundreds. They were of many species and all colors, red, brown, purple, black and flesh. Some were naked and shining, others clothed in bristly hairs to their very feet. All were repulsive, slow, and so awkward that it was inexplicable how creatures with such lack of correlation could ever manage to find food, much less a mate. They were always crawling slowly along, tumbling over every obstacle in their path. Ticks were much rarer than mites.

Numbers of very simple insects were common. Silverfish or Thysanura of several species ran like active little ghosts out of their hiding places and scurried swiftly to another which they fancied safer. Their nimble movements made them exceedingly difficult to capture. Collembolas, almost equally primitive, were usually white, but now and then a purple one appeared. Not

only were they capable of active running, but when the brush wet with alcohol was about to touch them, they leaped to a distance of twenty to thirty times their own length. Again and again this enabled them to escape. When they landed they remained motionless for some time and were most difficult to discover. Among the specimens collected were Campoclea, and many individuals of Collembola, belonging at least to three different genera *Isotoma, Lepidocyrtus* and *Schöttella.*

Termites, or "white ants," lived in small colonies of six to thirteen individuals in small twigs, in the upper layer of debris. Sometimes they seemed to be living in close association with real ants with no signs of hostility on either side.

A very few immature wood roaches represented the order Orthoptera, while the Hemiptera or true bugs had only a slightly better showing. Earlier stages of these insects lived in the middle layer, while those in the upper were quite adult and were ready to fly.

Beetles of small size were abundant and of numerous species. Of about fifty which I gathered, about sixty per cent were rove beetles. All the others were slow travellers, or on discovery pretended to be dead, but the rove beetles were very agile, and never lost any opportunity of trying to escape capture. There were members of Rhynchophora of the Tribe Tylodini; of the Families Thorictidae, Phalacridae, Pselaphidae and Tenebrionidae. Also of Clivina, Scyclonaenus, Oxytelus, and Platystethus; Staphylinidae were, as I have indicated, by far the most numerous.

Some tiny flies had apparently just emerged from their pupae in the upper layer, these being the only representatives of their order, while of the Lepidoptera there were only two small moths among the dry leaves of the top stratum.

Ants were the most abundant form of life, both in numbers and species. They lived in the upper layers and with the exception of the great, black, solitary fellows who apparently had been walking about on the top of the leaf stratum, all were of small size. Their colonies were apparently complete but very small, a very small twig being packed full of individuals from six to fourteen in number with a half dozen pupae.

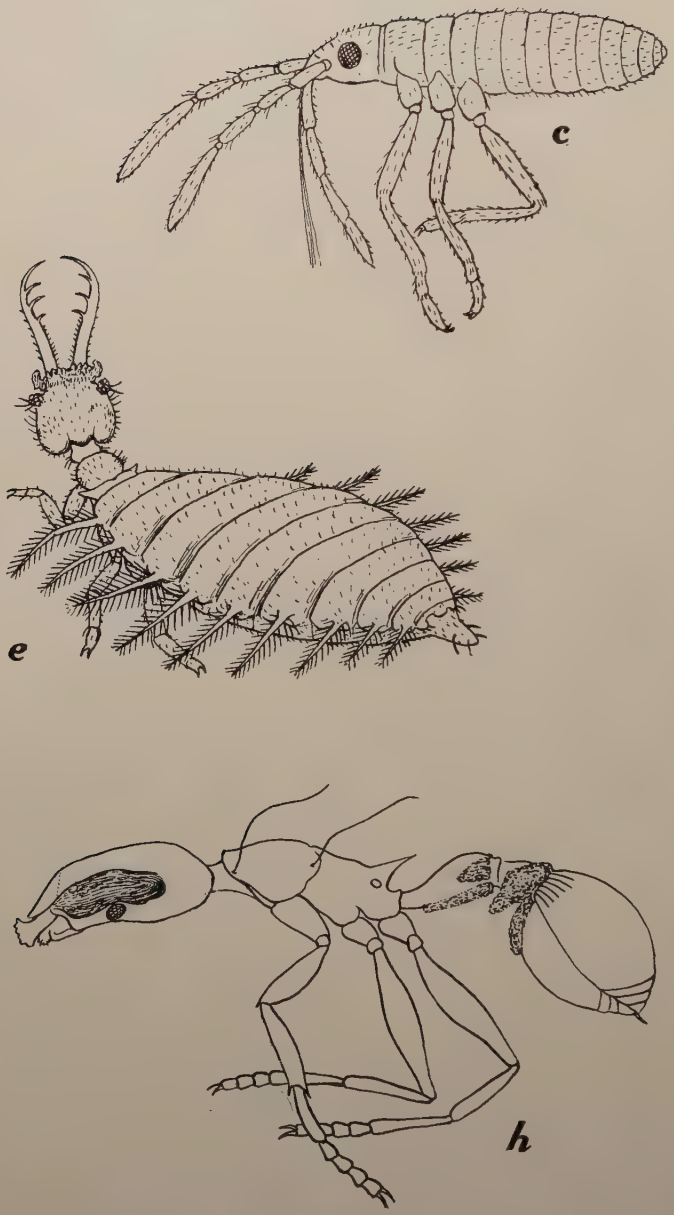


FIG. 19. REMARKABLE INSECT FORMS, CHIEFLY NEW
Found in the surface of a Tropical Yard of Jungle

c, Unknown form. *e*, An unknown form, possibly the remarkable larva of some Myrmeleonid species, related to the Ant-lions. *h*, The worker of a new genus and species of ant, *Glamyromyrmex beebei* Wheeler. This is also a subterranean form, living in small colonies in tiny twigs. In the colony from which the species was described, there were only three workers, three females, and two males.

Finally mollusks were found in small numbers, all very small, some with flat shells, others with steeply turreted ones. These were young specimens of two species of *Leptinaria* and several very young *Polita*, or *Vitrea* as it is more generally called.

In addition to all these was a host of unknown forms, immature or in some unrecognizable early stage of development. Some had huge jaws and the body encircled with a dense chevaux-de-frise of horny, frond-like spikes. Others were so simple that their relationships could only be guessed at.

One thing was evident early in my exploration. I was having to do with a world of small people. No insects of large size were in any layer of the debris. The largest would be very small in comparison with a May beetle. Another fact which impressed me was the durability of chitin. The remains of beetles, considering the rareness of living ones, was remarkable. The hard wing cases, the thorax armor, the segments of wasps, eyeless head masks, all these still remained perfect in shape and vivid in color. Even in the deepest layers where all else had disintegrated and returned to the elements these shards of death were as new.

Day after day as I worked with my face close to the mold, I was constantly aware of the keen, strong, pungent odor. It hinted of the age-old dissolution, century after century, which had been going on. Leaves had fallen, not in a sudden autumnal down-pour, but in a never ending drift, day after day, month after month. With a daily rain for moisture, with a temperature of three figures for the quicker increase of bacteria, and an excess of humidity to foster quick decay, the jungle floor was indeed a laboratory of vital work—where only analytic chemistry was allowed full sway, and the mystery of synthetic life was ever handicapped and ever a mystery.

Before the vessel docked we had completed our task and had secured over *five hundred* creatures from this lesser cosmos. At least twice as many remained, but in making calculations I estimated that the mold had sheltered a thousand organisms that were plainly visible to the eye.

When I had corked my last vial and the steward had removed the final pile of shredded debris, I leaned back and thought of the thousand little creatures in my scant four square feet of mold. Then there came to mind a square mile of jungle floor with its thin layer of fallen leaves sheltering many more than six billion of these creatures. Then I recalled the three thousand straight miles of continuous jungle which had lain westward up the course of the Amazon, and of the hundreds of miles of wonderful unbroken forest north and south. My mind faltered before the vision of the unnamable numerals of this uncharted census, of the insurgence of life which this thought embraced. It seemed quite clear that no Tyrant Antwren need ever go hungry, as long as he had strength to turn a leaf.

Leaving out the hints of vertebrates which in numbers were almost negligible, the lower types of creatures may roughly be grouped as follows:

Flatworms (Platyhelminthes)	2%
Roundworms (Nemathelminthes)	2%
True Worms (Vermes)	3%
Myriapods (Myriapoda)	6%
Scorpions (Scorpionida)	1%
Pseudoscorpions (Pseudoscorpionida)	8%
Harvest men (Phalangida)	1%
Spiders (Araneida)	3%
Mites and Ticks (Acarida)	14%
Silverfish (Thysanura)	2%
Collembola (Collembola)	3%
Termites (Isoptera)	10%
Roaches (Orthoptera)	1%
Bugs (Hemiptera)	2%
Beetles (Coleoptera)	10%
Flies (Diptera)	1%
Moths (Lepidoptera)	1%
Ants (Hymenoptera)	30%

As shown by this list, ants were the dominant form of life, so I have chosen to mention these in detail as representative of the interest of this method of investigation. They have been thoroughly worked out by Prof. Wheeler,* and the unexpected result of this mode of intensive study is well illustrated by a paragraph from one of Prof. Wheeler's letters. Referring to the nineteen vials of ants which I had sent him he says: "I have just found time to mount them up and to my surprise discover among them representatives of two new and remarkable genera! That you should have found these is indeed remarkable, because Professor Goeldi, formerly the director of the Pará Museum, collected ants very assiduously in that region and sent them to Forel for description. Moreover, one of my students, Mr. William M. Mann, who has been with me several years, collected very extensively in Brazil and recently enumerated all the known Brazilian forms with a description of the new species he had taken, and neither of these men came across the two very peculiar little ants which you found. I take it that they did not work in the leaf mould as you did and that probably when other collectors adopt your method an extensive ant fauna will be unearthed even in Brazil, which has been pretty well worked for ants within recent years. . . . I have named the two new genera and species *Blepharidatta brasiliensis* and *Glamyromyrmex beebei.*"

The seventeen species of ants which I discovered in this four square feet of jungle mould are as follows:

1. *Pachycondyla harpax* Fabr. (workers).
2. *Euponera* (*Trachymesopus*) *stigma* Fabr. (workers).
3. *Ponera opaciceps* Mayr. (workers).
4. *Anochetus mayri* Emery (deälated female).
5. *Solenopsis subtilis* Emery (workers, males, deälated female).
6. *Crematogaster victima* F. Smith. var. (deälated female).

*Two new Genera of Myrmicine Ants from Brazil, Bull. Mus. Comp. Zool. Harvard, LIX, No. 7.

7. *Pheidole flavens* Roger subsp. *exigua* Emery (soldiers, workers, males, deälated female).
8. *Pheidole subarmata* Mayr. (workers, deälated female).
9. *Trachymyrmex* sp. (deälated headless female).
10. *Cyphomyrmex rimosus* Spin. (deälated female).
11. *Rhopalothrix* (*Octostruma*) *balzani* Emery (workers, deälated female).
12. *Strumigenys subedentata* Mayr. (deälated female).
13. *Prenolepis steinheili* Forel (workers, males).
14. *Rhizomyrma goeldii* Forel (workers).
15. *Camponotus* (*Myrmothrix*) *abdominalis* Fabr. var. (deälated female).
16. *Blepharidatta brasiliensis* Wheeler.
17. *Glamyromyrmex beebei* Wheeler.

The solitary deälated females of the species of numbers 4, 6, 9, 10, and 15 were evidently establishing colonies. At least eight of the species, those of the genera 2, 3, 5, 11, 12, 14, and the two new genera 16 and 17 are hypogaeic or subterranean ants, with small-eyed workers. With the exception of numbers 1 and 15, all of the species are small or very small.

Taking ants alone, we thus find that in numbers they formed about thirty per cent of the visible fauna of the jungle mould. With the exception of the two species all were adapted by their small size to life in the leaf mould, and fifty per cent were structurally fitted for subterranean existence.

III.

I have made a single interesting comparison between this fauna of four square feet of tropical jungle debris and that of a corresponding area in a temperate and an Arctic latitude. In the tropical material, as I have stated, we found, at the very lowest estimate, one thousand visible organisms. In four square feet of leaves and moss from an uncleared area in the woods of the New York Zoological Park were two hundred and sixty creatures. From a slightly larger area, approximately a square yard, of tundra moss from Labrador, twenty-seven living organisms were unearthed. This last material consisted chiefly of

white reindeer moss, near a grove of fir trees from the North West River on Lake Melville, ninety miles directly west of Rigolet up the Hamilton Inlet. For this I am indebted to A. Sheard, Esq., of the Grenfell Association, who was kind enough to gather it personally for me.

The value of this comparison is, of course, relatively superficial, but nevertheless it is not without interest and should stimulate effort in this comparatively unworked ecological field.*

Fauna of Four Square Feet	(*New York*) *Temperate*
True Worms (Vermes)	14%
Myriopods (Myriopoda)	10%
Pseudoscorpions (Pseudoscorpionida)	1%
Harvest Men (Phalangida)	4%
Spiders (Araneida)	8%
Mites and Ticks (Acarida)	1%
Silverfish (Thysanura)	3%
Bugs (Hemiptera)	8%
Beetles (Coleoptera)	8%
Moths (Lepidoptera)	1%
Ants (Hymenoptera)	40%

The lists speak for themselves, the interesting facts being the marked diminution in number of general groups, as well as species and individuals from the tropics northward. The dominance of ants in both temperate and tropical cases is worthy of notice, and the remarkable number of true worms in the north and of mites and ticks in the south. In none of the lists are eggs or cocoons included.

Attempts to identify the tropical organisms have shown how little knowledge we have of the life histories of these invertebrates. It was indeed fortunate when even a genus or subfamily could be told. The lack of a great central museum, library and collection of types in our country is keenly felt, as well as the handicap of the general habit of publishing new species in all sorts of magazines and periodicals, wholly unrelated except by the widest of zoological bonds.

*Consult W. L. McAtee, Science, N. S., Vol. XXVI, pp 447-449, and N. Banks, id. p 637.